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# INDIAN MUSEUM NOTES.

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VOLUME II.—No. 1.

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## ECONOMIC ENTOMOLOGY.



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## NOTICE.

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THE serial *Indian Museum Notes* is issued by the Trustees of the Indian Museum, Calcutta, under the authority of the Government of India, Revenue and Agricultural Department. It is chiefly intended to record information on the subject of the Economic Entomology of India, and thus gradually to furnish materials upon which to base a comprehensive knowledge of this important subject, which has hitherto been but little studied. For the views expressed the authors of the respective notes are alone responsible.

The parts of the serial will be published from time to time as materials accumulate. Communications are invited; they should be written on one side only of the paper and addressed to—

The Editor,  
Indian Museum Notes,  
Calcutta.

Correspondence connected with Economic Entomology should be accompanied by specimens of the insects to which reference is made. Caterpillars, grubs, and other soft-bodied insects can be sent in alcohol; chrysalids and cocoons, alive, and packed lightly in leaves or grass; other insects, dried and pinned or wrapped in soft paper. Live insects should be sent when there is a reasonable probability of their surviving the journey. Caterpillars, grubs, and other immature insects can often be only approximately determined; they should therefore, where possible, be accompanied by specimens of the mature insects into which they transform; when, however, this is not possible, they should still be sent, as they can always be determined approximately, and uncertainty must necessarily arise in discussing insects when actual reference to the specimens cannot be made.

Insects forwarded for determination should in all cases be accompanied by a detailed report showing precisely in what their Economic importance consists.

THE EDITOR.

INDIAN MUSEUM,  
19th March 1891..





## INDIAN MUSEUM NOTES.

## No. I.—MISCELLANEOUS NOTES FROM THE ENTOMOLOGICAL SECTION OF THE INDIAN MUSEUM.

By E. C. COTES.

During the year 1890-91 the collection of information on the subject of the Economic Entomology of India went on as usual in the Entomological Section of the Indian Museum. The chief work of the year may be classed under the headings of, (1) Locusts, (2) Silk insects, (3) Reference collections, (4) Lectures, (5) Miscellaneous insects.

In the matter of Locusts, the habits and history of *Acridium peregrinum*, which is the chief locust of North-Western India, were investigated, and a detailed report was issued on the subject.

In the matter of Silk insects, all available information was collected concerning the wild species which produce silk in India, but which have not hitherto been cultivated, and progress was made with a report upon the subject, for publication in these *Notes*. The silk insects which are actually cultivated have been already dealt with in a report which was issued as Volume I, No. 3 of these *Notes*.

In the matter of the Reference collections which are being gradually got together in the Indian Museum, specimens of the insects sent to the Museum for report, were, as far as possible, preserved and identified zoologically for future reference. Help in the identification of the species was received from Entomologists in several quarters of the globe: for in India, where there are, at a moderate computation, some twenty thousand different kinds of insects, many of them unknown to science, the zoological identification of a species is often a matter of very considerable difficulty, while it is necessary that the insects should be identified, as without identification it is impossible to avail ourselves of what has been ascertained in other parts of the world about similar or allied forms. Communication therefore has been established with many of the chief Entomologists in different parts of the world, and several of them have assisted gratuitously by identifying the insects belonging to the particular groups which they have specially studied. In this connection may be mentioned the following Entomologists who kindly gave help during the past year in the identification of species of economic importance:—Dr.

Henri de Saussure of Switzerland; Messieurs Bigot and Desbrochers de Logis of France; Lord Walsingham, Colonel Swinhoe, and Messrs. Buckton and Moore of England; Mons. Kerremans and Dr. Auguste Lameere of Belgium; Mr. Maskell of New Zealand; Mr. Howard of the United States. Progress has necessarily been somewhat slow, but named specimens are accumulating, and it is already becoming the rule, instead of, as heretofore, the exception, when an insect is sent to the Museum as attacking a crop, for it to be practicable to identify it without delay and to refer to what is known about it.

In the matter of Lectures, a course on Forest Entomology was given in the Forest School in Dehra Dun, and it is hoped that the subject will be taken up hereafter by other agricultural bodies.

In the matter of Miscellaneous insects, a large amount of information was collected from the reports and specimens which have been received from Government officers, as well as from private individuals in all parts of India, a large portion of it being furnished through the various directors of Land Records and Agriculture, from whom much assistance has been received. It will be found embodied in the following *Notes*, which are necessarily very incomplete, though it is hoped that they will serve to bring to light points that were previously unrecorded in connection with the insects that attack crops in India. In compiling these *Notes* care has been taken to indicate what is already known about each pest, so as to facilitate the investigations which it is hoped hereafter to institute locally; for the experience gained during the past few years, in the attempt that has been made in Calcutta to investigate the subject of the pests and other insects, which in some cases are not to be found nearer than the other side of India, shows clearly that it is useless to expect to obtain anything like complete information, unless facilities are afforded for visiting the localities where the insects are actually at work.

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From the Secretary to the Municipal Committee in Amritsar were received in October 1890 caterpillars of a microlepidopterous moth which was said to have proved very destructive to millet and maize around Amritsar, none of the fields being free from it. The damage was variously estimated at from one-sixth to one-tenth of the crop. The caterpillars proved to be either identical with, or very closely allied to, the Sugarcane Borer (*Diatræa saccharalis*), described on pages 22 to 28 of Vol. I, No. 1 of these *Notes*. The maize stalks in which the caterpillars arrived having become somewhat dry, the caterpillars were transferred to pieces of sugarcane, into which they tunnelled eagerly. The sugarcane was periodically changed, but as yet (3rd March 1891) the insects are still

Maize Stalk Borer.



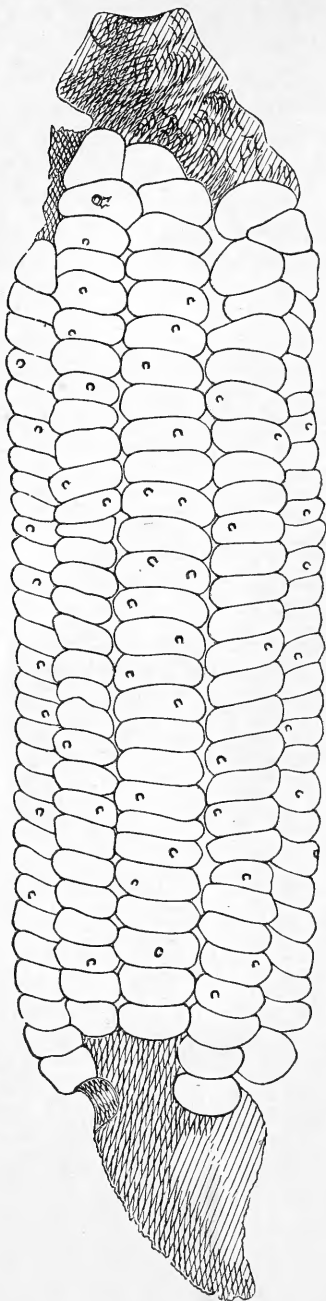
in the larval stage, showing that the insect passes the whole of the cold weather in the caterpillar stage within the stalks.<sup>1</sup> In the case of *Diatraea saccharalis* the eggs are deposited at the base of the leaf sheaths and the larvæ tunnel into the stalks, the chrysalis being formed in the tunnels and several generations being gone through in the year; and this no doubt will also be found to hold good when the insect attacks maize and sorghum. In their work on *Field and Garden Crops* Messrs. Duthie and Fuller notice that in the case of maize this insect is known as *Salai*, while in the case of sugarcane it is known as *Silai*, and in the case of sorghum as *Bhaunri*, the poisonous effect which *Sorghum vulgare* shoots sometimes have on cattle being attributed to it.

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<sup>1</sup> One moth emerged on 31st March, and four more on the 4th and 5th June, soon after heavy rain; these all undoubtedly belong to the species which habitually attacks sugarcane in India. In the North-Western Provinces, according to Duthie and Fuller, maize is sown about May or June, and is reaped about the end of August; so the caterpillar probably lies up in the maize stalks from the time of cutting until the plant springs up again, in the following June. In this case, on Dr. Riley's estimate of thirty days for a generation, about two or three generations would be passed through during the growth of the plant, followed by a nine months' hybernation. The evidence for this, however, is incomplete, and it is by no means impossible that intermediate generations may be passed through in sugarcane, which springs up considerably earlier in the year than maize.

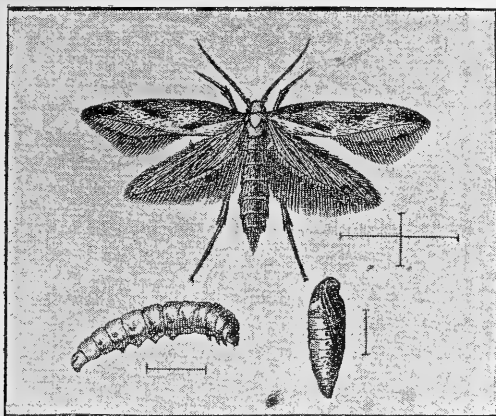
From the Revd. M. M. Carleton have been received American

The Anjoumois grain moth in Kulu.



maize cobs grown in Kulu and infested by the larvæ of a small Tineid moth, which is said to swarm in the granaries where the grain is stored. The insect was evidently very closely allied to the Anjoumois Grain Moth (*Gelechia cerealella*, Oliv.) described in the United States Entomological Report, 1884, page 345, but, as this insect had not been previously recorded from India, the specimens were submitted to Mr. L. O. Howard, Acting United States Entomologist, for favour of comparison with the American form. In reply, Mr. Howard writes : " So far as I can see, this moth is indistinguishable from the Anjoumois Grain Moth of this country and Europe, and I have carefully compared it with specimens upon which the illustrations and article in the 1884 Report were based."

The Anjoumois Grain Moth has long been known in the granaries of Southern Europe and of America. It is named after the old Province of Anjou in France, where it proved exceedingly destructive about a century ago. According to the observations which have been made by Entomologists in Europe and of America, the first eggs are generally laid in grain standing in the



fields. The eggs are laid on the ears, and the larvæ tunnel into the grain. The second and subsequent generations are spent in granaries. Each caterpillar tunnels into a single grain, and remains concealed until just before it transforms into a chrysalis. It then cuts a small round valve-like door which is pushed open by the emerging

moth. The chrysalis is enveloped in a slight silken cocoon inside the grain. The insect passes the winter in the caterpillar stage inside grain stored in granaries. The normal number of generations in the year is two, the first being spent in grain standing in the fields and the second in grain stored in granaries, but further generations sometimes occur under favourable circumstances. A temperature of  $104^{\circ}\text{F.}$ , when sustained for two days, is said to have been found sufficiently high to destroy this insect. The Anjoumois moth therefore is essentially the inhabitant of temperate regions, and is little likely to prove destructive in the plains of India. (The figures show the caterpillar, chrysalis, and imago of the insect, together with a maize cob attacked by it.)

From the Sub-Divisional Officer of Kurigram, Rungpore, were received

#### Cut worms.

in November 1890 Noctues larvæ said to do great damage to paddy by cutting off the unripe ears from the stalks. The insects were reared in the Museum, and in the early part of December produced moths which were found to belong to the species *Leucania extranea*. Caterpillars of the same species were received in the early part of December 1890 from the Collector of Rungpore, who reported that immense mischief had been done by them in many parts of his district. Specimens of a Cut worm probably identical with *Leucania extranea* were also received from the Manager of the Wards' Estate, Rungpore, who reported that the extensive injury caused by these insects, in cutting the paddy, had ruined many of the tenants, who had been impoverished by previous floods and locusts. The crops that were attacked were said to be nearly ready to be harvested, so that nothing could be recommended for use this year. It may be noticed, however, that the United States entomologists have recommended the destruction of Cut worms by strewing leaves poisoned with London purple over the fields, before the crop to be protected appears above the ground; while the

fact that the insect passes most of its time in holes in the ground, makes insecticide dressings, such as gas-lime, wood-ashes, and soot, likely to tend to discourage the increase of the pest. Frequent stirring of the ground also has been recommended as tending to expose the caterpillars to the birds which feed upon them, and in Ceylon tea gardens, according to Mr. E. E. Green, smooth conical holes sunk in the beds, when the earth is moist, have sometimes been found successful as traps. They should be made with a smoothly pointed stake pressed into the earth and rotated until the sides are smooth and firm, so that the caterpillars may be unable to climb out, when they fall into the holes in the course of their nightly wanderings.

Through the Director of Land Records and Agriculture, Bengal, were received in January 1890 specimens of *Noctues* larvæ, probably belonging to the species *Agrotis suffusa*. These insects had proved destructive to rabi crops both in Murshidabad and in Tipperah. In Murshidabad the Canoongoe of Jungipore reported that altogether he estimated the produce of 2,000 bigahs of land to have been destroyed; the crops chiefly attacked were wheat, barley, gram, oats and peas, oil-seeds and some pulses appearing to be untouched; the insects attacked the very young plants only, the older plants escaping. The only remedy known was irrigation, which caused the caterpillars to come to the surface, where they were exposed to the birds; irrigation, however, was practicable only in some cases. In the Sarail estate, Tipperah, the injury was chiefly confined to young tobacco and potato plants, mustard growing close by being untouched.

From Mr. J. Cockburn were received in March 1890 notes and specimens illustrative of the Cut worms which had recently attacked poppy, gram, pea, linseed and mustard crops in Oudh, many of the cultivators complaining that their individual losses during the season from Cut worms, to crops other than poppy, amounted to from twenty to twenty-five rupees. In the case of poppy fields, both larvæ and pupæ were found in March, the pupæ in the loose damp earth of the ridges between the poppy beds, where they stand erect in the ground from two to four inches below the surface. The larvæ were reared and proved to belong, in some cases, to the species *Agrotis suffusa*, and in others to the species *Ochropleura flammatra*, both belonging to the family Noctuidæ of the group *Noctues*. Moths of the species *Agrotis suffusa* were rarely seen, but the moths of *Ochropleura flammatra* crowded at night into the house, being apparently attracted by the light, and were largely destroyed by bats. In a subsequent note Mr. Cockburn observes that moths of *Agrotis suffusa* again began to appear in the middle of September 1890.

*Noctues* larvæ were received in January 1891 from Mr. R. H. Morris, of Mysore, who wrote :—

“Another pest is doing very great damage to my estate. It is a grub or

caterpillar (*Agrotis suffusa*, I think) well known to planters by the popular and significant name 'Ringer.' It eats the bark of the young coffee plants under two years old, in a ring right round the stem, sometimes just above, but generally just below the surface of the ground; the result being that in the dry weather the plant withers and dies, while in the wet weather apparently healthy and vigorous plants suddenly snap and fall over with the first gust of wind. In this latter case occasionally a good sucker is thrown out, which takes the place of the original broken stem. I believe I am well within the mark in saying that I have lost some fifteen thousand fine young plants during the past year, and some idea of their numbers may be gained by my informing you that I have destroyed by hand-picking, during the last two months only, over 1,10,000. These were brought in by the coolies in all stages of growth from little wee threads to big fat caterpillars an inch and a half long and as thick as a lead pencil. I am sending you by post a few specimens which I hope may reach you alive. Hand-picking is not satisfactory, because in the first place, after a field has been searched, plants can be killed by the 'Ringer' before the coolies get round to that field again; secondly, many very young plants are killed, by the searchers having exposed their roots to the sun, as the grubs frequently retreat to a considerable depth in the day-time; and, thirdly, it is an expensive way of getting rid of them, and is out of the question if labour be scarce. I am applying kerosine emulsion to the stem close to, and just below, the ground, with a band of quicklime on the ground right round, but an inch or two away from, the stem. I am afraid, however, that the useful properties of both of the above are too evanescent for the purpose."

The caterpillars were reared in the Indian Museum and in the end of February there emerged moths belonging to two very distinct species of Noctues. One of these is *Agrotis segetum*, and the second, being hitherto unrepresented in the Museum collection, has been sent to Europe for precise identification. The insect *Agrotis segetum* is well known in Europe as a most destructive Cut worm: some doubt, however, has been expressed as to its occurring in India. It may be useful, therefore, to notice that, besides the specimen from Mysore, the Indian Museum contains representatives of this species from Ceylon, and also from such localities along the Himalayas as Sikkim, Kulu, and Solon. In the Catalogue of the Moths of India also, by Cotes and Swinhoe, the insect is recorded from the Nilgiri Hills, Mhow, Poona, Quetta, Dubrai, Hyderabad (Sind), and Thundiani (Punjab). In England, according to Curtis (Farm Insects, 1860) *Agrotis segetum* passes through two or more generations in the year, hibernating in the larval stage and forming its chrysalis in the ground; and very much the same habits, no doubt, obtain in India.

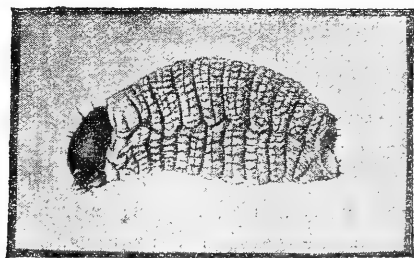
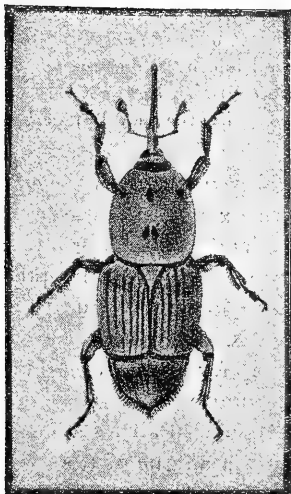
In the end of January 1891 numerous caterpillars of a Noctues moth, belonging either to *Agrotis suffusa* or an allied species of Cut worm, were received through the Bengal Agricultural Department, both from the Jalpiguri district and also from the Santhal Pergunnas. In Jalpiguri the insect is known as *Dora*, and is said to attack the roots of tobacco, potato, and chilli plants, doing considerable injury. In the Santhal Pergunnas the insect is known as *Nagara chandra*, and is said to be found in large numbers in the wheat fields, generally from three to five inches below the surface of the ground. They are found chiefly in fields

that are comparatively damp, and do considerable damage to young plants, migrating from one plot to another. Rain and irrigation bring them to the surface, when they are greedily eaten by the birds.

In February 1891 some Cut worms were forwarded by the Manager of Baboo A. N. Roy's estate, Berhampore, with the information that they damaged mustard, potato, linseed, and tobacco plants. The insects were thought likely to have belonged to some species of *Leucania* or *Agrotis*; the material, however, was insufficient for precise identification.

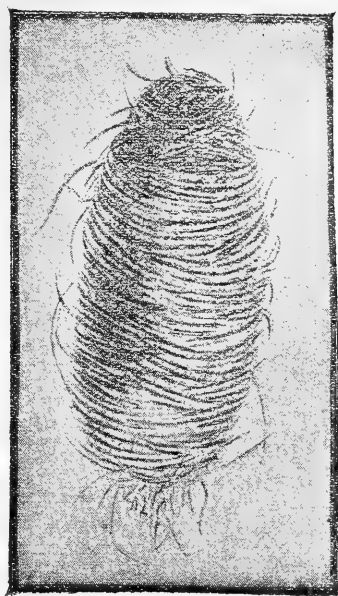
From the Superintendent of the Government Horticultural Garden in Lucknow were received in April 1890 specimens, in various stages of development, of the

Palm Weevil.



Palm Weevil, described by Ridley in his report on the "Destruction of Coconut Palms by Beetles," Government Press Singapore, 1889, under the name of *Rhynchophorus ferrugineus*. In Lucknow, the insect was found to attack the stems of the date palm (*Phoenix dactylifera*). The Superintendent writes:—

"The tree from which these were taken blew down a few days ago. At the base and for half the height of the stem it was quite decayed and full



of the refuse created by the larvæ of the beetle. The upper part was fresh and the leaves green, and until the tree came down it was not noticed to be in bad condition. On examination, a number of other trees were found to be similarly affected, and will no doubt fade before long."

In October the same insect, both in the grub and

beetle stage, was found by Mr. Gollan in the stems of date palms in the Saharanpur Botanical Gardens. The trees killed by the weevils had been imported about four years previously from the Persian Gulf, and it was thought possible that the insect came with them, as neither the wild date nor any other species of palm in Saharanpur had been similarly attacked.

According to Mr. Ridley's Report, this insect attacks both healthy and unhealthy trees. It generally lays its eggs at the base of the leaf stalk, though it also takes advantage of any mechanical injury to the stem, or of holes drilled by the *Rhinoceros* beetle (*Oryctes rhinoceros*) for depositing its eggs. The beetles fly chiefly at night and are often found concealed in the holes of the *Rhinoceros* beetle. As with other wood-boring insects, it is probably the case that unhealthy trees are more subject to attack than healthy ones. The only remedies that have been suggested are the obvious ones of destroying the beetles wherever they are found, and of burning trees that are badly infested to check the increase of the pest. Trees however that are not very badly attacked should be spared, as they are said to recover in many cases. (The figures show the beetle, with its grub, pupa, and cocoon, also side views of the head of the male and female to show the difference in the snout of the two sexes.)

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The minute moth which proved destructive to bales of country  
 Determination of miscella- blanketing in the Calcutta Army Clothing  
 neous pests, Department in 1887 has been examined by

Lord Walsingham, who reports that it is a *Setomorpha* (Tineidæ), which he is unable to distinguish from the African species, *Setomorpha rutella* of Zeller.

The common little case-making moth found everywhere on house walls in Calcutta has been identified by Lord Walsingham as *Tinea pellionella*. The moth which has proved destructive to raw wool in the Economic Section of the Indian Museum also appears to belong to this species.

A minute moth referred to in Vol. I, No. 2, of these *Notes* as destructive to the lentil plant (*Ervum lens*) in Patna has been determined by Colonel Swinhoe as *Laphygma exigua*, Guer. (Family,—Apamiidæ).

The Microlepidopterous insect whose larvæ were found by Mr. W. J. Simmons boring into the stone of mango fruit in Calcutta, and which forms its pupa case in the ground, has been examined by Colonel Swinhoe, who reports that it is a new species belonging to a new genus allied to *Maruca* (Pyrales, Margaronidæ).

The moth whose larva was found, by Dr. Prain feeding on ornamental oat plants in the Botanical Gardens in Calcutta, in January, has been identified by Colonel Swinhoe as *Leucania extranea* = *separata* (Noctues, Leucaniidæ); *vide* Catalogue of the Moths of India, No. 1674.

An Acridid received on 25th February 1889 from the Collector of Murshidabad as destructive to crops in that district (*vide* page 107 of Vol. I of these *Notes*) has been determined by Dr. Henri de Saussure as a variety of *Acridium succinctum*, St.

Some Acrididæ mentioned in Vol. I, No. 1, of these *Notes*, where they were said to be known as *Bhunga* or *Ankphutta*, and to defoliate sugarcane in Cawnpore, have been determined by Dr. Henri de Saussure as belonging to the species *Oedalus marmoratus* of Linnæus, and *Pæcilocera hieroglyphica* of Klug.

A dipterous insect of the Family Tabanidæ, forwarded by Mr. J. Cleghorn as attacking cattle in Baluchistan, has been determined by Mons. J. M. F. Bigot as belonging to the species *Chrysopsis dispar*, Fabr., which is said to be common throughout Southern Asia.

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In February 1890 were received from the Deputy Conservator of

Kulsi Teak Borer.



Forests, Kamrup, Assam, specimens of a boring insect which has proved destructive to young teak trees in the Kulsi plantation. The insects were found to be larvæ of a Cerambycid beetle, probably identical with the species of *Stromatium* previously reported as injurious in this locality.

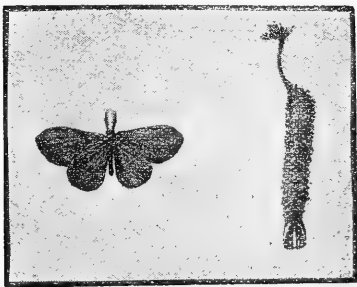
An imago also found in the Museum, marked "Kulsi Teak Borer," and probably the insect described in a note by Mr. A. G. Mein, which appeared in the *Indian Forester* in 1879, has been identified by Dr. Lameere as *Stromatium asperulum*, White. According to the account given by Mr. Mein in 1879, the insect had been noticed since 1873. It chiefly attacks trees that are in their first or second year's growth, though trees five and six years old are also attacked. The presence of the borer is usually marked by a swelling in the stem near the ground, and below this swelling can often be seen a small puncture from which excrement of the grub protrudes. This puncture, no doubt, represents the tunnel formed by the young larva in boring its way into the wood, from the spot where the egg was previously laid by the mother beetle in the bark. After a hot day the affected trees tend to have a faded appearance, but this symptom is not

always present, and some trees remain apparently healthy until the larva has tunnelled so far into them that they snap off with the wind. The swelling, which appears where the borer is at work, is thought to be due to the efforts made by the tree to repair the damage, and to strengthen the stem where it is being weakened. These efforts appear in many instances to be successful, for the trees often recover. In 1877 the Forest Officer of Gauhati collected some affected stems and reared the insect. He obtained beetles in the end of June from logs which in March had contained only larvæ. But nothing further is known of the life history of the insect, beyond the fact that the larvæ are to be found in young teak

stems all the year round, so that the insect probably takes at least two years to pass through its various stages. In the Kulsī teak plantation the practice that was adopted in 1879 was to coppice all young trees that were badly attacked, and to encourage the growth of the strongest shoot from the stool to form a new tree by removing all other shoots as fast as they appeared. It was found best to leave older and more vigorous trees alone, provided they showed no signs of fading, as in many cases they recovered.

With the exception of the single specimen from the Kulsī teak plantation, the Indian Museum collection contains specimens of *Stromatium asperulum* from the Malay Peninsula only, *Stromatium barbatum* being the common Indian form. An application, therefore, was made to the Forest Officer of Kulsī for further specimens of the beetle which had been injuring the teak trees. In reply, specimens were forwarded of no less than three very distinct species of Cerambycidae, viz. *Stromatium barbatum*, *Neocerambyx holosericeus*, *Ægosoma lacertosum*, the species *Stromatium asperulum* not being represented. Teak logs said to contain the grubs were also furnished, and an attempt is being made to rear the beetle from them in Calcutta, as it will be interesting to learn the part played by the different species, the probabilities being that most of the damage is due to some one kind of insect. (The figures show the beetle *Stromatium asperulum*, with some of the larvæ, furnished by the Deputy Conservator, Kamrup.)

The small Psychid, the cone-like cases of whose caterpillars are commonly to be found upon rose bushes, *Lagerstræmia* Psychid. *Lagerstræmia indica* bushes, and other ornamental shrubs in Calcutta gardens, has been determined by Mr. F. Moore, who



writes:—"This moth and its case are identical with a species of *Psychidæ* which I have in my collection under the MS. name of *Babula grotei*, the type specimen of which was reared at Alipur by the late Arthur Grote from cases found upon the Babul." The following description of the species has been kindly furnished by Mr. Moore:—

"*Babula grotei*,—upper and under sides uniformly pale cupreous brown, wings sparsely covered with short, very slender, laxly disposed, hair-like scales; ciliæ long, dense; expanse of wings  $\frac{1\frac{1}{2}}$ th of an inch. *Habitat*,—Calcutta. Type in collection of F. Moore."

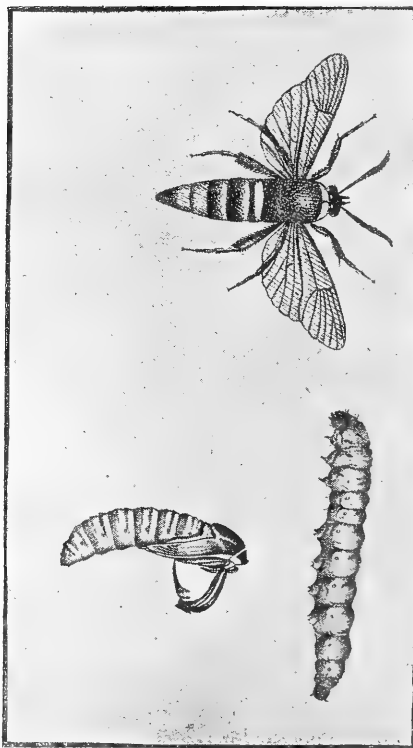
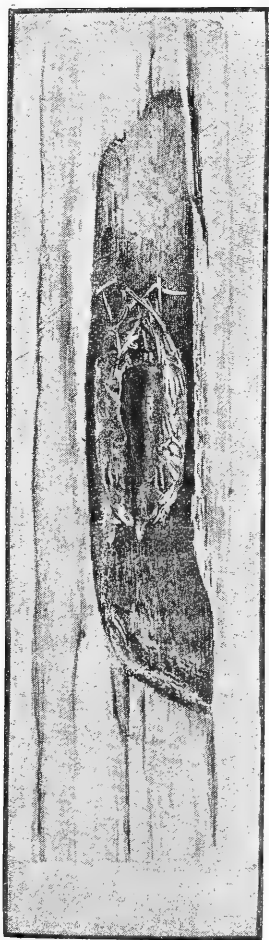
The insect does a good deal of damage in Calcutta gardens as a defoliator. The eggs are probably laid by the female inside her case. The young caterpillars at first thatch themselves with little rough bits of leaf, gradually adding to the case thus constructed and making it bigger and neater as they grow older. When full fed, they spin themselves up into their cases, which they suspend from some convenient branch by silken threads. They then turn themselves round inside the case, so that the head rests where the tail has previously been. In this position, inside the case, the caterpillar shuffles off its larval skin and becomes a chrysalis, the male moth finally emerging from what was previously the tail end of the caterpillar's case, and generally leaving part of the chrysalis skin protruding from the case, as shown in the figure. The male is the active little moth depicted in the figure; the female has not yet been observed, but is likely to be a wingless grub-like animal which passes the whole of her life inside the case. London purple wash was tried for destroying this insect upon ornamental shrubs in Calcutta; the results, however, were not satisfactory, though it is only fair to add that the wash was mixed and applied by an unskilled native *mali*, so the fault may have lain with him, and not with the insecticide. The immediate result of applying the wash was to kill the leaves, so that the shrubs consisted for some time of nothing but apparently dry twigs. But, though the leaves were killed, it was found that many of the caterpillars spun themselves up inside their cases on the bare twigs and remained alive during the whole time the shrubs were without leaves, the consequence being that when fresh leaves appeared the caterpillars descended upon them and began eating them up as industriously as before. (The figure shows the male moth, together with the pupa case from which it emerged).

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In January 1890 Mr. T. T. Leonard reported injury to apple trees in Bangalore by the aphid *Schizoneura lanigera*. An account of this insect is given on page 51. Kerosene emulsion has proved useful in some cases in keeping this insect in check, but in many cases the destruction of infested trees has appeared to be the only effectual means of dealing with the pest. The life history of the insect has not yet been observed in India, but is no doubt very much the same as what obtains in Europe. In Europe, according to the observations of Lichtenstein, as recorded in the Entomologists' Monthly Magazine, 1878, page 134, a winged sexless female begets the wingless male and female which do not feed but produce the winter egg, which develops in the spring into the wingless female. These wingless females settle down, and, after moulting a number of times, form the gall, and reproduce themselves asexually; their offspring again, which are also wingless, migrate to some fresh spot and then settle themselves

down and moult, as their mother did before them. This asexual reproduction of wingless females goes on through a number of generations until the autumn, when winged asexual females are produced. These winged asexual females produce the wingless sexual form, from which, after copulation, the single winter egg is produced. The root and branch inhabiting forms belong to one and the same species. The galls on both roots and branches are morbid growths of the vegetable tissues, due to the irritation set up by the wingless females in feeding upon the plant. The downy excretion with which these females are covered serves to a great extent to protect them from the weather. Honey tubes are absent, so the insect is not protected by ants.

In Peshin, Baluchistan, according to Mr. J. Cleghorn, the poplar  
Baluchistan Poplar Borer.



tree, which constitutes the most generally useful wood of the country, suffers severely from the attack of a boring insect. This insect proves to be the caterpillar of an *Ægeriid* moth, allied to the species which attacks poplar trees in England; it has been kindly examined by Mr. F. Moore, who determines it as a new species of *Sphacia*, which he describes below as *Sphacia ommatiaeformis*. The poplar trees are grown from cuttings and when about two years old they are almost invariably attacked by the caterpillar, which bores through the trunk and riddles it in all directions close to the ground, generally killing off the stem before it gets to be five years old, but leaving the roots intact, so that fresh shoots are made from the ground. These shoots, having well established roots to support them, generally manage to survive the attack of the insect and to repair the damage by throwing fresh wood around the injured portion. The loss therefore that is occasioned by the insect, chiefly consists in the throwing back of the growth of the young trees by two or three years. Now, as the tree is a fast-growing one, this loss is very considerable, two-year old trees being often as much as fourteen feet high, with trunks two and a half inches in diameter, when they are killed down by the pest. Out of thirty-five trees, planted out five years previously, Mr. Cleghorn found remaining eight of the original trees which had survived the attack of the insect, fifteen trees, each apparently from three to four years old, and twelve trees each one to two years old, all growing upon the original roots and derived from the shoots sent up after the original stems had been destroyed by the insect. With regard to the life history of the insect, from May to September, only caterpillars could be found in the burrows in the trunks, but in September chrysalids began to be formed in cocoons made of chips and situated near the entrances of the burrows, and moths appeared in October. The eggs therefore are probably laid in the bark in the early part of the cold weather, as the coldness of the Peshin winter makes it unlikely that the moths could hibernate, though the amount of fatty matter found in the body of the moth makes its hibernation in this stage by no means impossible. Whether, however, the moth lays its eggs soon after it emerges in the autumn, or hibernates and lays them in the spring, the cycle of the existence of the insect probably extends through one year.

The moth, which has been reared in the Indian Museum from stumps forwarded by Mr. Cleghorn from Baluchistan, is a small clear winged *Ægeriid*, and so closely resembles the wasp *Vespa cincta* in appearance as to be easily mistaken for it when looked at superficially; and this likeness, as in the case of other mimicking insects, no doubt affords the moth a considerable degree of immunity from the attack of the birds which would otherwise feed upon it, *Vespa cincta*, with its powerful sting, not being an insect to be molested with impunity. (The figures show the

caterpillar, pupal case and moth of *Sphecia ommatiformis*, also a section of the tunnel containing the cocoon of chips in which the pupa is formed.)

In addition to the *Ægeriid* caterpillars a few *Buprestid* larvæ were forwarded by Mr. Cleghorn as found boring into the poplar trees, one of them being also received from the Deputy Conservator of the Forest Circle, Quetta. Nothing has been ascertained on the subject of the habits of this insect, and specimens of the beetle into which the larvæ transform must be procured before its identification can be determined. It is not expected, however, that it will be found to play more than a subordinate part in injuring the poplar trees.

The description kindly furnished by Mr. F. Moore of the *Ægeriid* moth is as follows:—

“*Sphecia ommatiformis*, n. sp., Moore.

*Male*.—“Head above and thorax chestnut-red; face yellowish, sides whitish; thorax with a prominent gamboge-yellow frontal collar; abdomen chestnut red, each segment with an anterior pale yellow band; second and third joints of palpi gamboge-yellow, the basal joint being bright chestnut-red; legs beneath dark chrome-yellow, legs above chestnut-red and darkest on the tips of the tibiæ. Wings semi-transparent, very pale reddish-ochreous; costal edge, the veins, and ciliæ chestnut-brown; antennæ chestnut-red. Expanse of wings  $1\frac{1}{2}$  inch. *Habitat*.—Baluchistan.”

This species is allied to *S. dasypodiformis*, Walker (Catal. Lep. Brit. Mus. VIII, page 12).”

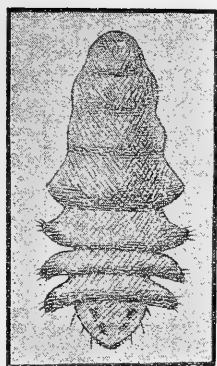
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The Toon Twig Borer, *Magiria robusta* (Microlepidoptera), which was described on page 35 of Vol. I of these *Notes* as injurious to *toon* trees in Ceylon, has been observed during the past two years as extremely injurious to the *toon* trees which line the roads in Dehra Dun. The caterpillar mines the succulent twigs, constantly destroying the leading shoot, and causing adventitious shoots to be given out on all sides. This goes on year after year, the leading shoot being constantly destroyed, and the trees becoming a mass of stunted branches with no well defined trunk above a few feet from the ground. The insect is chiefly found in young trees, but its work is only too apparent in the majority of the old trees, very few of which have anything approaching a well-grown trunk. Nothing has yet been recorded of the life history of the insect beyond the fact that in Ceylon moths were reared in October from larvæ which became full fed and formed their chrysalids inside the twigs in the latter part of September. The only measure which has been suggested for keeping the insect in check has been the cutting off and burning of the affected shoots; the number of trees, however, which are affected in Dehra Dun, makes any such treatment quite out of the question.

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From Mr. Marshall Woodrow, of Poona, were received in October

Areca Palm Coccid, in the Konkan.



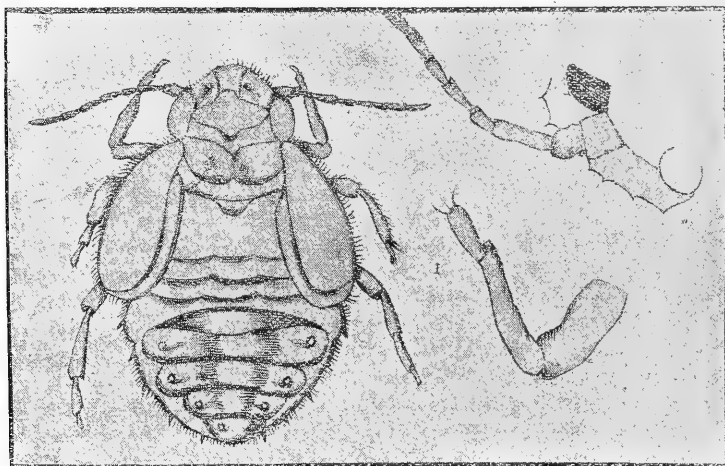
1890 specimens of a coccid said to attack the *Suparee* nut palm. (*Areca catechu*) in the Janjira State, on the coast, about 80 miles south of Bombay, the outturn of dressed beetle nuts having been reduced by the ravages of the pest, from 10 lbs. per tree to 1 lb. per tree. The trees were said to have suffered for the last twenty-five years from this insect, which has become specially troublesome during the past six or seven

years. The specimens were submitted to Mr. W. Maskell, who has kindly furnished the following note on the identifications of the species:—

"The insect is, as regards the female, so much like *Chionaspis aspidistra*, Signoret, that I may consider it identical with that species. The female puparium agrees in its yellow colour and pyriform shape; the second pellicle is rather large; and the enclosed insect has the remarkably prominent abdominal segments, as shown in the enclosed rough sketch, characteristic of *C. aspidistra*. As far as I can make out, *Aspidistra* is a genus of half a dozen species of ornamental plants in China and Japan; and it seems quite likely that (supposing you to have none of the genus in India) this scale may have other food plants, of which one would be *Areca catechu*. I could not, amongst the numerous specimens you sent me, discover any male puparia. In *C. aspidistra* these would be small, white, narrow and carinated. In the absence of the perfect certainty which these puparia would give us I think my diagnosis of the female is probably correct."

With regard to remedies, Mr. Woodrow recommended the people to fire the badly-affected trees and to wash those which were but slightly attacked with an emulsion made in the proportion of one gallon of water, one ounce of sulphate of copper, one ounce of kerosine oil, and a handful of cowdung, to be applied three times at intervals of a few days, so as to destroy the young as fast as they emerged. It may also be noticed that, as the experience of entomologists in the United States has shown that kerosine and soap emulsion is the best application for destroying Scale insects of all kinds, recourse might be had to it, if the treatment suggested by Mr. Woodrow should prove insufficient. Full directions for the preparation of kerosine and soap emulsion will be found in earlier numbers of these *Notes*.

From the Calcutta Agri-Horticultural Society were received, in the early part of July 1890, blighted indigo shoots, with the information that, according to an estimate made by Messrs. Jardine, Skinner & Co., the indigo crop



in Bengal has been reduced by about one-third this season, the loss, which amounts to several lakhs of rupees, being ascribed to blight. The indigo shoots were found to be covered with minute black scales, each containing a partially developed homopterous insect, which was at first supposed to be one of the Aphidæ, but which has since been described by Mr. G. B. Buckton as the pupa of a new species of Psyllidæ, which he names *Psylla isitis*. The description kindly furnished by Mr. Buckton is as follows :—

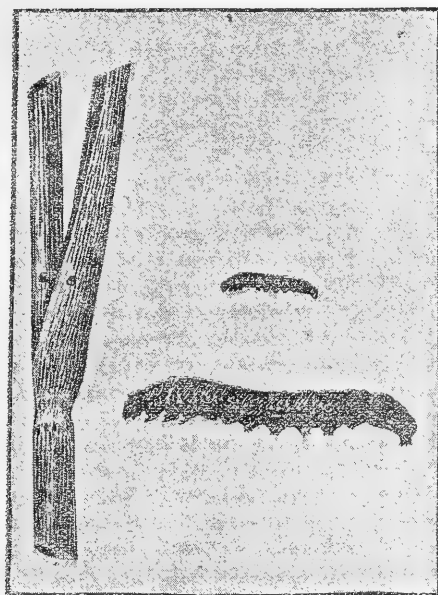
*Psylla isitis*, nov. sp.

“*Pupa*.—Colour shining yellow with the edges of the abdominal somatic rings rich brown. Vertex bristly, eyes angularly faceted, large and red. Rostrum short and stout, proceeding from between the eyes, and lying between the fore coxæ. Pronotum corrugated and tuberculose. Antenna with eight joints, the two basal joints stout and somewhat globose; the third and eighth joints the longest. Wing-cases double, but not separate. Abdomen globose, the somata edged with rich brown, and marked with stigmata. Tarsus obscurely two-jointed, ending with one claw and two bristles. The larval form is smaller than the pupal, and has less developed antennæ and feet. Size 0·05 × 0·03 of inch.”



In September 1890 were received through the Agricultural Department of Bombay, caterpillars of a microlepidopterous insect reported by

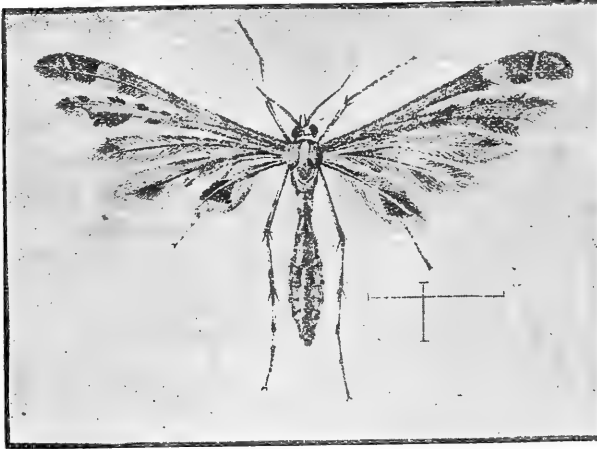
Padi Borer in Thana.



the Collector of Thana to have done a considerable amount of damage to paddy during the past two years in his district. The specimens were insufficient for absolute determination, but were either identical with, or very closely allied to, the Rice Stalk Borer (*Chilo oryzaellus*) of the United States. A very similar insect has been described as destructive to paddy in Perak, though it has not yet been ascertained whether the species found in Perak is identical with that which occurs in the United States. With regard to remedies, the observations of

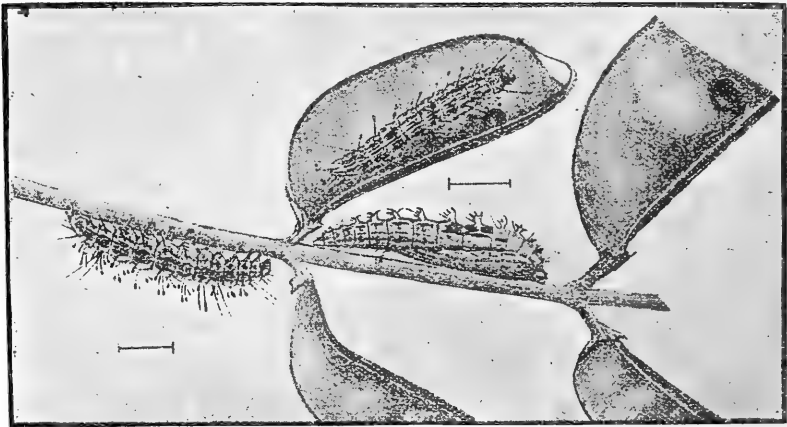
Mr. Howard in the United States, and of Mr. Wray in Perak, have shown that the insect passes the time between the harvest of one year, and the springing up of the crop of the following year, in the self-sown paddy, and perhaps also in the stems of large grasses, which spring up in and around the paddy fields. The careful destruction therefore of these by burning has been thought to be the most promising means of reducing the numbers of the pest. According to Mr. Wray, eggs are laid in batches at the base of the leaves, 600 eggs being sometimes laid by one female. These eggs hatch a few days after they are laid, and the caterpillar at first feeds on the leaves, but after a short time it bores its way into the inside of the stem, where it passes the rest of its caterpillar existence. The chrysalis is formed either in the leaf stalk or inside the stem. A generation takes about two months; so, there are several generations in the course of the year. (The figure shows the caterpillar, natural size and enlarged, together with a piece of rice straw tunnelled by it.)

In December 1890 were received, from the Overseer of the Government  
Lablab Plume Moth.



Farm, Nagpur, amongst other pests, pods of *Dolichos lablab* tunnelled by the larvæ of a minute Plume moth. The caterpillars were reared in the Museum and the moths were forwarded to Lord Walsingham, who identified them as belonging to the

species *Sphenarches caffer*,<sup>1</sup> of Zeller<sup>1</sup>. Lord Walsingham gives the synonymy of this species as follows:—



<sup>1</sup> Lord Walsingham notes that a pupa case, sent to him from West Africa, corresponds precisely with the figure made by the Indian Museum artist from a Nagpur specimen, and that the only difference he has observed between the moths from Nagpur and those that have been sent to him from Africa, consists in the Nagpur specimens having the tooth of dark scales, on the hind margin of the third lobe of the hind wings, a very little further removed from the apex, even this slight difference not holding good throughout a series from Burma. Should it turn out, however, that there are two species, then the name *S. caffer*, of Zeller, will belong to the African form.

## "SPHENARCHES, Meyr.

"♂ ♀ CAFFER, Z.

*Pterophorus caffer*, Z.—Hand. Kong. Svensk. Vet-AK., 1852, 118.*Oxyptilus caffer*, Z.—Lin. Ent., VI, 348-49 (1852); Wkr. Cat. Lep. Ins.

B-M. XXX, 934 (1864); Wlsm., Tr. Ent. Soc., 1881, 279; Meyr., Tr. Ent. Soc., 1887, 268.

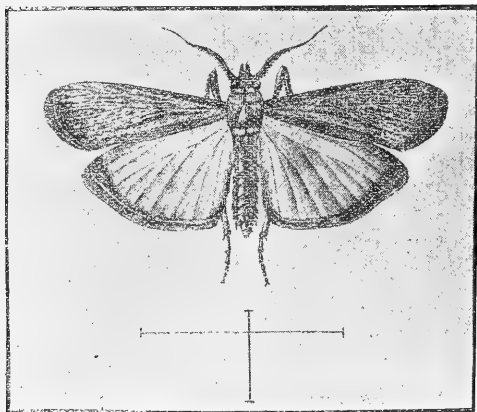
"*Sphenarches caffer*, Meyr.—Tr. Ent. Soc., 1887, 268."=*Oxyptilus anisodactylus*, Wkr.—Cat. Lep. Ins. B.—M. XXX, 934-353 (1864); Moore, Lep. Ceyl., III, 528 (1887); Meyr., Tr. Ent. Soc., 1887, 268. (Type ♂ ♀ B-M.)"=*Oxyptilus walkeri*, Wlsm.—Tr. Ent. Soc., 1881, 279; Meyr., Tr. Ent. Soc., 1887, 268. (Type, Cape Town Mus.)"=*Sphenarches synophrys*, Meyr.—Tr. Ent. Soc., 1886, 17; 1887, 268. (Type, ♂ Mus. Meyr.)"*Larva*—on "Calabash" (West Africa): in "Lablab" pods (India)."*Imago*—March (N.-S.-W.)"*Hab.*—Australia (N.-S.-W.), New Hebrides, Tonga Is.

Africa (Natal, Caffraria, Gambia, East Africa).

Asia (India, Ceylon, Burma, Japan).

(Type, ♂, Stockholm Mus.)"

From Mr. L. Wray, Jr., Curator of the Perak Museum, were received  
 Perak Pomelo Moth. in October 1890 specimens of the moth which he



has found destructive to pomeloes, limes, and lemons in Perak. The specimens were forwarded to Mr. F. Moore, who identified them as belonging to a new species of *Phycitidae* which he describes as *Nephopteryx sagittiferella*. The following is his description:—

"*Nephopteryx sagittiferella*, nov. sp., Moore.

"Closely allied to *N. physostigmalis*, Walker, described in the Proceedings of the Royal Physical Society of Edinburgh for 1869, the larva of which is stated to feed upon the 'Esere' or 'Ordeal Bean' of Old Calabar.

"Fore wing slightly broader, paler ferruginous, brown, the costal area and between the outer veins silvery-grey; on the discal area is a transverse curved series of elongated very acute sagittate points, which are blackish and with a greyish outer line; at the end of the outer veins is a prominent blackish pointed-dot. Hind wing also broader, pale, pinkish cinereous, silvery-grey along the anterior border (not brown, as in *N. physostigmalis*); veins externally, and the marginal and ciliary line, brown.

Body dark cinereous brown ; head, thorax, palpi, antennæ, fore and middle legs ferruginous brown ; hind legs pale cinereous brown.

"Expanse of wings ♂ 1, ♀ 1½ inch. *Habitat*.—Perak."

The following is Mr. Wray's summary of his report upon the subject :—

"At the request of the British Resident of Perak, I made an enquiry into the cause of the destruction of all the pomelo fruit grown in the Residency gardens at Kwala Kangsa, and have ascertained, from actual observations and breeding experiments, that it is primarily to the attacks of the caterpillars of a small moth that the loss is due.

"The life-history of this insect is, as far as I have been able to observe it, as follows :—

"The eggs are laid singly and in small irregular patches on the lower side of the fruit, and when they hatch out, the young caterpillars eat their way into the fruit, making a number of minute holes through the rind, generally over an area of about the size of a shilling. The pith under this patch is riddled with holes, and gum is often subsequently found, both in the cavities of the rind, and also on the outside of the fruit.

"As the caterpillars increase in size, they eat their way through and through the fruit, and make holes through the rind to eject refuse, and also possibly to obtain air. To these holes uneatable portions of the fruit and faecal pellets are carried by the caterpillars and ejected.

"The caterpillars, which are active, quick-moving insects, jump and twist when touched, and, for caterpillars, can progress with considerable speed. On arriving at maturity they leave the fruit, and, descending to the ground bury themselves in the earth to undergo the change into the pupa state; the caterpillars make in the earth cells of agglutinated earth, lined with white silk; they measure 0·7 inch in length, 0·4 inch in breadth, and 0·3 inch in depth.

"On the twelfth day after quitting the fruit, the transformation is complete, and the moth forces its way through the cell and up out of the earth.

"The perfect insect is about an inch across the wings, and of a warm brown colour, with shadings of silvery grey. In the day-time it is very quiet and sits usually on the earth of the breeding cages, the head and forepart of the body being much raised, and the antennæ laid back on the wings, which are closed and folded closely over the body. When in this position, it is a very inconspicuous object, both as regards colour and form. At night it seems to be lively and is possessed of fairly good powers of flight.

"The first four moths I raised all died in a little over two days, and though they consisted of two of each sex, no eggs were laid. On dissection of the females I found the eggs to be immature and few in number, and deduced from their state that the insect does not deposit its eggs until some days after leaving the chrysalis and that during that time it needs food to enable it to perpetuate its species.

"With the next brood of moths I put various fruits, but none of these seemed to their taste, for, though they lived for five or six days, and laid a few eggs, none of these proved fertile. In all I raised over thirty of these insects without getting one egg that would hatch.

"It seems quite possible that, as the fruit on which they feed during the caterpillar stage is seasonal and that there are periods of months at a time during which no food is available that the moths are long-lived, and until their natural food during the imago portion of their lives is discovered, attempts at artificial breeding will be unsuccessful.

"*Egg*.—Oval, dirty white, translucent, with fine raised, irregular network covering

surface. Length .04 inch, and breadth .025 inch. When laid, they take the form of flattened ovals, with the lower side following the shape of the object on which they are laid, and the upper surface convex.

"*Larva*.—General colour bluish-green, tinted above with pinkish bronze. The four anterior segments being less tinted than the remainder; the young are almost wholly of a rather dull pink. Length of adult .86 inch, breadth .15 inch.

"*Pupa*.—General colour warm brown, darkening towards the tail, wing sheaths dull green for the first few days, after which they become dark brown. A dark median line from tail to thorax on the dorsal aspect. Length .5 inch, breadth .17 inch.

"The caterpillar of the pomelo moth is able to pierce uninjured the natural defences of the fruit. Disregarding both the pungent oil of the rind, and the thick layer of pith beneath it, it reaches the cellular portion of the fruit, which it tunnels through and through in all directions, passing through the seeds if they happen to be in its line, but apparently not seeking them out. Fæcal matter is deposited in the burrows, and decomposition as a consequence quickly sets in on its walls. Under the microscope the fluid contents of any cell which has had its containing sac broken by the passage of the caterpillar is seen to be teeming with bacterial life of many kinds. Carefully detaching a sac adjoining one that had been broken by a caterpillar, but which was in itself quite perfect, and microscopically examining its contained fluid, there appeared many bacteria. The most frequent form being masses of cocci, many other forms were present, but in smaller numbers.

"An oval *saccharomyces* was very plentiful in the injured cells, and is the probable cause of the acid fermentation which takes place in them. It was not present in the adjoining unbroken ones. Presumably the smaller forms only can pass from cell to cell through the connecting vessels.

"It is probably to this secondary attack of micro-organisms that the premature ripening and falling of the fruit may be ascribed, more than to the actual injury done by the caterpillars themselves; other insects taking advantage of the holes made by the caterpillars through the rind can enter the fruit and lay their eggs in the pith and pulp, with the result that large rotten patches spread from the entrance and exit holes. These insects are two or three species of flies, and a small brown beetle, all of which are attracted by any decaying fruit.

"The life-history of the pomelo moth shows that there is only one period of its existence when there is any hope of destroying it in useful numbers, and that is when it is in the caterpillar stage inside the fruit. The eggs are small, and so like the oil cells on which they are laid that without a lens it is difficult to see them; in the pupa state, which is passed beneath the ground, they are well out of reach, and in the perfect stage, being strictly nocturnal and very inconspicuous, there would be little chance of doing any good.

"The only suggestion that I can make is to destroy all fruit that is seen to be inhabited by the caterpillars, or which falls from the trees. The destruction of the fruit which falls is of importance, not only as a means of killing the insects contained in it, but also as preventing its serving for the rearing of another brood.

"As the eggs seem to be laid only on the fruit itself, it would appear that if the young fruit is put into bags, that they would have a chance of arriving at maturity.

"I am inclined to think that the wild species of *Citrus*, known by the native name of *Limau kerbau*, and which is apparently nearly allied to the pomelo, *Citrus decumana*, is the natural food of these caterpillars, as it is a fairly common tree in the jungles of some parts of Perak.

"Since writing the above, bagging the fruit in common thin white cloth has been tried in the Government gardens, with complete success.

"Quite recently I have found that the common limes, and also European lemons

are attacked, and large numbers of them destroyed by the same insect. The moth bred from them is indistinguishable from those bred from pomeloes.

"Nothing but the destruction of all infected fruit would be of any use in mitigating the ravages of the pest in the case of limes and lemons."

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The cosmopolitan insect *Heliothis armigera*, which has been previously referred to in these *Notes* as attacking opium, cotton, and leguminous plants, has recently been noticed in Ceylon, where, according to Mr. E. E. Green, it feeds upon the fruit of the Cape gooseberry, *Phipalis* (?) *peruviana*, often completely destroying the crop. It remains concealed within the persistent calyx that envelops the fruit, and devours the succulent berry. Caterpillars also, which are thought to belong to this species, though the material has been insufficient for precise identification, have been received, in most cases accompanied with a small percentage of larvæ of other moths, from the following:—(1) The Officiating Collector of Backergunge, who reported that in the Patuakhali Sub-division, where the insect is known as *Leda*, the injury done to rice in December 1890 had amounted to an average of about one anna in the rupee. (2) The Collector of Khulna, who reported in February in 1891 that the insect had proved injurious to paddy in his district. (3) The Deputy Commissioner of Sambalpur, Central Provinces, who reported that the insect was known locally as *harnipok*, and attacked rice: it was said to be comparatively scarce just then, though in previous years it had been numerous enough to damage the crop. (4) The Commissioner of Excise in Bengal, who reported in February 1891 that the insect had been damaging the hemp plant (*Connabis indica*).

According to the observations which have elsewhere been made upon this insect, the larvæ feed in the open upon the leaves and pods of various plants, several generations being passed through in the course of the year. The pupæ seem in most cases to be formed in the ground, the only exception being when they attack poppy capsules, in which case (according to the observations of Mr. Scott) the pupæ are formed within the capsules. In the United States the insect has been found in most cases to hibernate in the pupa stage, though a few of the moths which emerge late in the autumn are also thought to survive the winter.

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Specimens, in all stages of development, of the fly which attacks melons in Baluchistan, have been received from Mr. J. Cleghorn, who has written an interesting paper upon the subject. The specimens were forwarded to Mons. J. M. F. Bigot, who kindly examined and described the insect as

*Carpomyia paratalina*, a new species which belongs to the group of Muscidae distinguished by Rondani as *Tephritoidi*, and is hence allied to *Tephritis onopordinus*, Fabr., which, according to Miss Ormerod, mines the leaves of celery and parsnips in Europe. Mons. Bigot's description of the species will be found on page 50.

According to Mr. Cleghorn's observations, which were made in Peshin (5,000 feet), the Baluchistan Melon Fly hibernates as a pupa from September, and in some cases from July, until April, two or more generations being gone through in the summer months, the later broods being especially numerous and destructive. The insect passes about four days in the egg stage, fourteen days in the grub stage, thirteen days in the pupa stage, and twenty days as an imago: its cycle of existence therefore consists of something over a month. The egg is deposited in the rind, several eggs being often laid in a single hole. The egg-laying is chiefly done in the morning, the fruit selected for oviposition being usually very young, sometimes with flowers still attached. The eggs hatch about four days after they are laid and the grubs work their way towards the seed pulp. The passage grows together behind them as they advance, so that a few days after the egg is laid, the hole in the rind closes up and the tunnel disappears, leaving no sign of attack. The maggot therefore cannot obtain air from the exterior, and it is supposed that it breathes the air contained in the seed cavity. This view appears to receive confirmation from Mr. Cleghorn's observation that in cucumbers and vegetable marrows, in which there is little or no seed cavity, the young grubs remain near to the original hole in the rind, eating out a cavity in the pulp, and only making their way towards the seeds when they have eaten out so large a quantity of the pulp that there is no chance of the passage filling up behind them. When about a fortnight old the maggot becomes full fed; it is then much like a small grain of rice in general appearance, and has its mouth armed with a pair of hooked mandibles and its posterior end provided with the usual paired breathing organs. When full fed, the maggot cuts its way out of the melon and pupates in the ground, where, in the summer time, it remains about a fortnight before emerging as a fly, and where the autumn brood hibernates until the spring. The life of the fly itself is a brief one, about twenty days being the longest that it has been found to live, even when plentifully supplied with melon pulp upon which it feeds. When a melon contains numerous grubs, it becomes stunted and does not develop, but when not more than five or six grubs are present, growth does not seem to be interfered with, unless indeed the grubs cut their way out, in which case the fruit decays. In the case of well-grown fruit, which is full of juice, the grub always cuts its way out of the upper portion,—apparently in order to avoid being choked by the juice,—the practice therefore of constantly turning the fruit in the sun to ripen it

prevents the emergence of the grub and saves the fruit from rotting. The Melon Fly does considerable injury to the melon crop, especially towards the end of the summer, when the later generations of grubs begin to emerge. Mr. Cleghorn recommends enclosing the fruit in muslin bags, which he endeavours to show would repay their cost, many times over, in increased production of melons. He is of opinion that hard winters kill the majority of the hybernating pupæ, so that it is after mild winters that the insect is chiefly abundant.

The following reports have been kindly furnished by Messrs. Green, Kerosine emulsion on Coffee Crow and Shelley, who have experimented upon their Ceylon coffee estates with a force pump, furnished by Messrs. Woodin & Little of San Francisco for applying kerosine emulsion for the destruction of scale insects:—

“I am now able to report, from personal experience, upon your pump and the kerosine emulsion treatment for ‘green-bug.’ I find that the cost is not excessive, varying from about R20 to R30 per acre according to circumstances (nature of land, water-supply, &c.); but I am not satisfied with the results. I find that with the greatest care it is impossible to thoroughly saturate the tree with the mixture, and that a very large percentage of the insects escape. Even some of those that were fully exposed to the spray were afterwards found to have survived the treatment, although the leaves on which they were fixed had been partially scorched by the action of the kerosine. Where the insects were actually killed, the young larvæ were afterwards seen to be crawling in numbers from beneath the dead bodies of their parents. I made the emulsion according to the formula given in Hubbard’s *Insects affecting the Orange*, and diluted it before using in the proportion of one part emulsion to nine parts cold water, as recommended in the same work.

#### Particulars of cost

To spray 1 acre—

250 gallons diluted mixture = 25 gallons of the emulsion = 16½ gallons kerosine, costing at local rates	R16·00
Four pounds, common soap	„ 0·80
Application, 10 men @ ·37 cts.	„ 3·70
Total cost per acre	„ 20·50

“This experiment was made under the most favourable conditions, the land being comparatively level, and there being an abundant supply of water to hand. This particular form of pump is not the most convenient for the work. The cost of application would be much less if a Vermorel knap-sack pump were used. The principal faults of the present pump are:—(1) The bucket and pump being separate, it requires two men to work and transport the machine. (2) The distributing hose is not long enough, and at its junction with the pump should be guarded with a Bodifield hose-protector to prevent kinking. Of the nozzles, the one with adjustable cap is the most convenient. It gives as good a spray as the cyclone nozzle, and is more readily cleared than the latter. But, unless it can be shown that the treatment is really fatal to the bug (of which I am not assured), it matters little what form of pump is used.

“I have unfortunately been unable to find any one willing to co-operate with me



in testing this treatment. Mr. W. Jackson and others to whom I have applied say that they would have no time to attend to the work, and also that they are not now so much troubled with the pest. Mr. Shelley seems to have confined his experiments to young plants in nurseries."—(E. E. Green.)

"At the request of Mr. E. E. Green I am returning you a force pump which you had lent him for the purpose of spraying bug-infested coffee, and which he at my request sent on to me to try some experiments in the same way. I regret to say that the emulsion of kerosine oil was not satisfactory, and the insect seemed to get on the trees almost at once after the application. Pure kerosine seems to have some influence in destroying the bug, but it at the same time rots the skin of the young coffee berries, so that it cannot be used while the crop is on the trees, which in some districts here is practically all the year round. I fear it is useless trying to contend with this pest on a large scale and that we have to look forward to the complete extinction of coffee in this island ere long."—(J. G. Crow.)

"It has been an unfavourable season for trying the pump, as we have had hardly any bug to speak of; and what we have had has been on isolated trees here and there; so I am quite unable to say anything as to cost. But I have been much pleased at the result of the emulsion applied with the pump, and all I can say is that under ordinary circumstances, such as not too steep a lay of land, and with water handy, I believe it would be quite easy to keep the bug in check."—(F. H. Shelley.)

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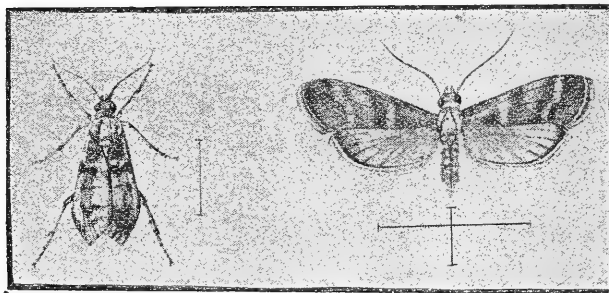
In May 1890 was received from the Department of Land Records and Agriculture in Madras a packet of weevilled cholum seed (*Sorghum vulgare*), infested by numerous specimens of *Calandra oryzae* (wheat and rice weevil), also of the common Ptinid (? *Rhizopertha pusilla*, Fabr.), a single specimen of *Silvanus surinamensis* being also found. The injury to the seed appeared to be chiefly due to the *Calandra* and *Ptinid*, which are the two insects that do most of the injury to stored wheat in India, *Silvanus surinamensis* being also a common granary pest which is often found in wheat. As far therefore as can be judged from this sample, it seems that stored sorghum seed and stored wheat in India have common enemies, and that any measures found useful in protecting the one are likely to be efficacious with the other.

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From the Superintendent of the Government Museum, Madras, have been received specimens of six species of Acrididæ said to have been the locusts which proved destructive in the Madras Presidency in 1878. The specimens comprised the species *Acridium æruginosum*, Burm., represented by about half a dozen individuals, and *Acridium melanocorne*, Serv. var., *Mecopoda*, sp., *Truxalis turrita*, Linn., *Euprepocnemis*, sp., and *Pachytylus cinerascens* (?), Linn., each represented by one, or at most two individuals, the single specimen of *Pachytylus cinerascens* (?) being in such a poor state of preservation that its specific identification was somewhat doubtful.

So far therefore as these specimens enable us to judge, it appears that neither *Acridium peregrinum*, which is the chief locust of North-Western India, nor *Acridium succinctum*, which was probably the Bombay locust of 1882-83, were concerned in the Madras invasion of 1878. A considerable amount of damage was undoubtedly done by Acrididæ over a wide area in the Madras Presidency in 1878, and the official reports upon the subject seem to show that while Orthoptera of all kinds were particularly abundant in that year, all over the presidency, most of the injury was done by swarms belonging to a single species whose identity therefore has yet to be established.

From Mr. J. Cleghorn were received in September 1890 some pomegranates tunneled by the larva of a Microlepidopterous moth. The insect was reared in



the Museum and the specimens were forwarded to Mr. F. Moore, who has identified them as belonging to a new species of *Phycitidæ*, which he describes under the name of

*Nephopteryx punicælla*. The following is the description kindly furnished by Mr. Moore:—

*“Nephopteryx punicælla.”*

“Allied to the European *N. abietella*, but smaller in size, grey; forewing numerously covered with greyish black scales, but differs from *abietella* in not having the marginal blackish dots; it has a similar transverse discal or postmedial pale narrow wavy band, and also an antemedial similar band; the other markings are also similar. Palpi, antennæ, and eyes black; head, thorax, legs, and abdomen blackish, the latter with greyish segmental bands.

“Expanse of wings  $\frac{7}{8}$  inch.

“*Habitat.*—Baluchistan.”

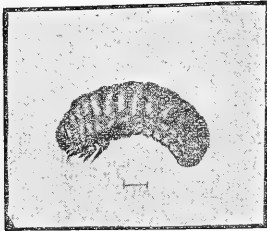
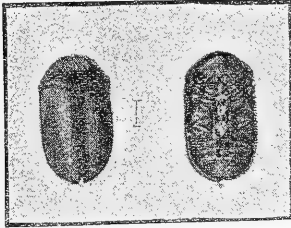
In August 1890 the Commissioner of Bhagalpore forwarded some paddy plants said to be suffering from the attack of a minute insect known locally as *Mara*, which weakens the plant by sucking up the juice of the leaves. The insects are said to be so small as to be scarcely visible to the naked eye. They occur only in rice fields where there is a scarcity of water, and the damage caused by them has not been very extensive. The leaves of the

plants that were forwarded to the Indian Museum were covered with what appeared to be a black felted fungoid growth; but the specimens were so old and dry that very little could be made of them. No insects were found, but the fungoid growth may possibly have followed the attack of plant lice on the rice plants.

The beetle, *Lasioderma testaceum*, noticed in Part I of these *Notes* as attacking cheroots, rice, and the leaf coverings of opium balls, has recently been reared

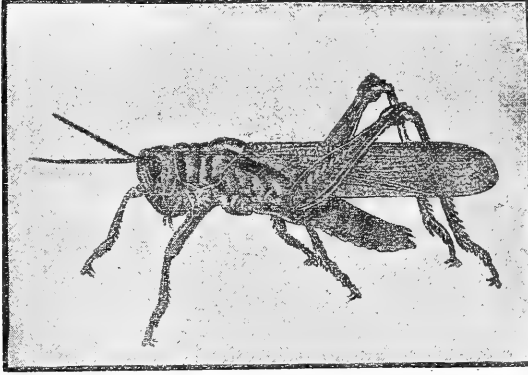
*Lasioderma testaceum.*

in the Indian Museum from pieces of saffron which were found to be tunneled by its larvæ. The larvæ are the little white grubs depicted in the figure; they tunnel into various substances. The external hole, which is usually the first intimation which is noticed of their ravages, is cut by the beetle when it emerges. \* (The figures show the grub and beetle enlarged, also still further enlarged drawings of the legs and antenna of the beetle).



In August and September 1890 a good deal of damage was done in the Rajpipla State, and in the Panch Mahals, Broach, and Thana districts of the Bombay

*Hieroglyphus furcifer*.



Presidency, also in the district of Sambalpur in the Central Provinces,<sup>1</sup> by grasshoppers belonging to the species *Hieroglyphus furcifer* and its allies. The insect was noticed (*vide* Vol. I of these Notes, page 203) as destructive both in the Central Provinces and in Guzerat during the rains of 1889. The specimens that were

forwarded to the Museum were found to vary so much in their size and markings that Dr. Henri de Saussure, to whom they were submitted, was of opinion that the more extreme forms should be looked upon as constituting a second species, for which he proposed the name of *Hieroglyphus colesiana*. The specimens, however, which have since been forwarded by the district officers, tend to show that the peculiarities upon which the new species was based are merely due to individual variation. It seems likely therefore that the whole of these insects belong to the one species, *Hieroglyphus furcifer*, which, however, is a somewhat variable one. It is probably non-migratory in its habits, and there is no record of any definite measures adopted against it, though the injury it occasions appears in some cases to be considerable. In Sambalpur, according to the report of the Deputy Commissioner, the insect lays its eggs in cracks in the ground in the early part of the cold weather, the young hatching out with the commencement of the following rains, and often occasioning considerable injury to the young rice plants. In Broach, where, according to the Collector's report, the green standing crops were said to be suffering, the ravages of the insect were effectually put a stop to by a heavy fall of rain, which was supposed to have killed off the pest. In the Panch Mahals, according to the Collector's report, the insect was said to have been injuring maize, rice and *Banti* (?) crops, the loss in some villages being estimated at as much as ten per cent. of the whole. In Thana,<sup>2</sup> according to the Collector's report, the insect was said to

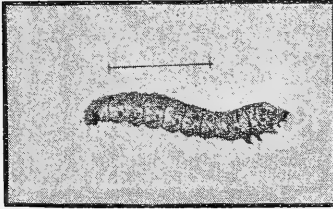
<sup>1</sup> Specimens of the same insect were also received in January 1890 with the information that it had proved destructive to crops in the Kolhapur State (Bombay).

<sup>2</sup> The specimens forwarded from this district as responsible for the injury were accompanied by a few grasshoppers of the genus *Tryxalis*.

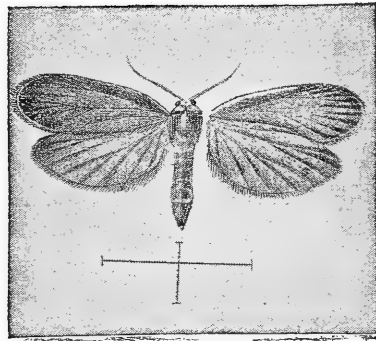
have done much mischief to rice that was coming into ear, by destroying the immature grain. In the Rajpipla State the insect was said to have also been noticed in some places in 1889.

The Wax Moth, whose caterpillars attacked the combs of the

Wax Moth.



Ligurian Bee (*Apis mellifica*, var. *ligustica*), which was reared experimentally in the Indian Museum, has been determined by Mr. F. Moore, who writes:—  
 “I have examined this moth and find that it is the species that is so commonly found wherever honey bees are reared, both in England and in other parts of Europe. The moth is *Achræa grisella*, Zeller, and is termed the ‘Honey Moth’ being a great pest and very destructive in its habits of tunneling through the combs. It belongs to the family Galleriidæ.”



Specimens of the Rice Hispa (*Hispa anescens*), referred to on page

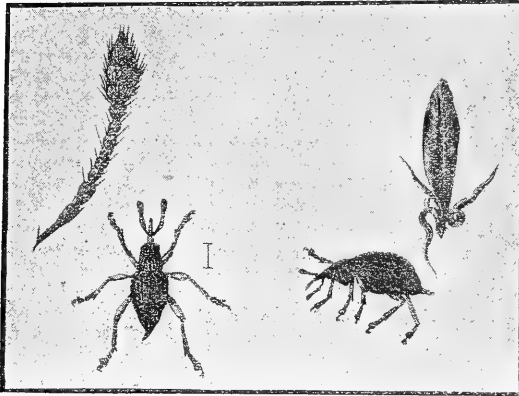
Rice Hispa.

37 of Vol. I of these Notes, have been forwarded during the past year by the district officers of Howrah, Backerganj, and Khoolna, also by Mr. C. H. C. Adamson, of Mandalay. In Howrah the insect is known as *Shanki poka*, in Khoolna as *Sanka poka*, and in Backerganj as *Mazra*. In each case it is reported to have been destructive to the rice crops. The Khoolna report notices that it breeds in low-lying grass which it attacks in the same manner as paddy, the injury occasioned during the past year being less than usual, owing to the heavy rain which is said to check the insect. This insect eats away the parenchymatous tissue of the leaves,

thus weakening the young paddy plants and decreasing the outturn of rice. No practicable remedy is at present known for it.

The Curculionid destructive to the seed of *Strobilanthus pectinatus*

*Strobilanthus* Weevil.



(*kibu*) in Sikkim has been determined by Mons. Desbrochers de Loges, as a new species of *Apion*, which he names *Apion strobilanthi*. The *kibu* is a herbaceous weed which grows at an elevation of about 6,000 feet in Sikkim and is used for fodder. In the rains of 1889 the only plant which was observed by

Mr. Gilbert Rogers to flower, had the whole of its seeds destroyed by this insect. (The figure shows the insect with its antenna (much enlarged), also a *kibu* pod attacked by it).

From the Superintendent of the Botanical Gardens, Bangalore, were

Cotton pests in Seringapatam.

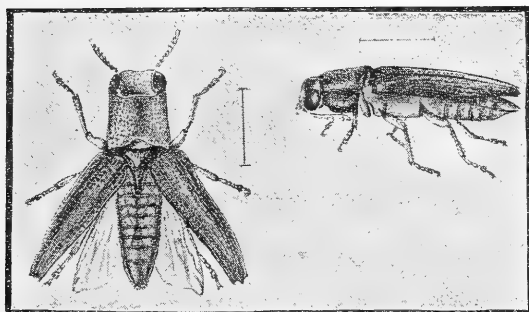


received in March 1890 specimens of the heteropterous insect *Oxycarenus lugubris*, Mostch., of the family Lygaeidae, said to have proved injurious to cotton in Seringapatam, where, in the early stages of the growth of the plant, fumigating with tobacco had been found efficacious in keeping down the pest. This insect has previously been reported as injurious in Ceylon, where it infests the ripe cotton pods and discolours and cakes the cotton. Nothing further is known of its habits. The cotton was also said to suffer from the

attack of a hemipterous insect probably belonging to the species *Dysdercus cingulatus*. This insect is allied to the "Cotton stainer" (*Dysdercus suturellus*) of the United States, where it is said to puncture the cotton bolls and injure the fibre, also puncturing the rind of oranges and causing the fruit to drop. The remedies recommended for the American species have been, poisoning the insects by traps of sugarcane trash, mixed with Paris green or destroying them when collected upon piles of cotton seed or orange peel, with hot water or kerosine and soap emulsion. It is extremely doubtful, however, to what extent such remedies will be found practicable in India. (The figure is that of *Oxycaenus lugubris*, much enlarged.)

In October 1890, from the Overseer of the Government Farm, Nagpur,

Cotton Buprestid in Nagpur.



were received cotton stalks tunneled by the larvæ of a Buprestid beetle which has been identified by Mons. Kerremans as a new species of *Sphenoptera* which it is proposed to call *Sphenoptera gossypii*. The larvæ

were reared in the Museum and produced imagos in November; the insect was said only to attack the country varieties of cotton, the American varieties escaping. With regard to the identification of the species Mons. Kerremans writes :—

“ Les espèces actuellement décrites de ce genre, et habitant l'Inde proprement dite sont au nombre de onze ; ce sont, *ærosa* Gmel. (= *ænea* F. = *tricuspidata* Ol.), *indica* Cast. et Gory, *orientalis* Cast. et Gory, *perroteti* Cast. et Gory, *pulchella* Cast. et Gory, *angustata* Thoms., *lafertei* Thoms., *nigrescens* Thoms., *piceiformis* Thoms., *eupriventris* Kerr., et *cyaniceps* Kerr. (ces deux derniers décrites dans un tout récent mémoire sur les Buprestides du Chota Nagpur). Parmi ces espèces, il n'en manque que trois à ma collection, ce sont *lafertei*, *piceiformis*, et *pulchella* et le spécimen que vous m'avez envoyé ne se rapporte ni à aucune de mes espèces ni aux descriptions des espèces qui me manquent. C'est donc une espèce nouvelle... Il se distingue des autres espèces par sa forme parallèle, par sa tête aussi large que le thorax et ses yeux, prominents, par son écusson très grand et cordiforme, et par ses tibias postérieurs incurvés. L'espèce dont il se rapproche le plus est le sp. *angustata*, Thoms., mais celui-ci a le front sillonné, l'épistome tout autrement conformé, et le dessous est d'un cuivreux brillant très prononcé. Sa ponctuation générale est aussi très différente.”

From Mr. E. Green were received in February 1890 specimens of an Aphid which is said to attack young Ceylon Tea Aphid. tea plants in Ceylon, sometimes doing



*Ceylonia Thæcola*

considerable injury. According to Mr. Green's account, published in the *Ceylon Independent* newspaper, both the winged and wingless forms are found in great numbers on the young succulent shoots in nurseries, and the irritation which they set up causes the edges of the leaves to curl and become distorted. The life history of the insect has not as yet been completely traced, but Mr. Green has observed that both the winged and wingless forms reproduce themselves parthenogenetically, the young settling down beside the mother and becoming full grown in about ten or twelve days after they are born. Honeydew is secreted in the usual way by glands on the dorsal surface of the abdomen, and the insect is consequently attended by ants. It is devoured by the larvæ of *Syrphidæ*, *Hemerobidæ*, and *Coccinellidæ*, besides being parasitized by a minute *Ichneumonid*, and the combined effect of these insects is so considerable that the Aphid is often completely kept in check by them. Wood ashes, powdered sulphur, and dry carbohc powder, have all been found



useless as applications for destroying the pest, but washes made of dilute kerosine emulsion or of phenyle are found to be efficacious; the proportions recommended are one part of kerosine emulsion to eighty parts of water, or one part of phenyle to two hundred and forty of water. The wash should be applied in the evening or on a cloudy day, as hot sunshine, following its application, is apt to scorch the leaves. In the case of phenyle the application of the wash should be followed the next morning by a copious drenching with ordinary water.

The specimens were submitted to Mr. G. B. Buckton, who kindly examined them and reports that the insect belongs to a new genus and species of Aphidæ which he names *Ceylonia theacola*.

The following is his note on the subject :—

"The Ceylon Tea Aphis appears to be anomalous and undescribed, and the form has no representative in Europe, as far as I know. In the general appearance of the body, the antennæ, and the cornicles, it follows the genus *Aphis*, but the single furcation of the cubital vein sharply separates it from that genus, and in this particular it more nearly follows *Schizoneura*. I presume, however, that the Tea Aphis neither rolls leaves nor forms galls, neither has it a flocculent covering. The lower wing also shows some modification in the disposition of the oblique veins. I think it will be desirable to place this Aphis under a new genus, and for the present I suggest for its name *Ceylonia theacola*, which is trivial and not therefore binding to any particular character.

"Genus CEYLONIA.

"Antennæ long and seven-jointed, third and fourth joints nearly equal. Cornicles cylindrical and rather long. Upper wings with the cubitus once forked. Stigma large; oblique veins two. Lower wing with two oblique veins running nearly parallel to each other; tarsus with one joint."

"*Ceylonia theacola*, nov. sp.

"Colour dark brown or black. Apterous insect, globose, shining, finely punctured. Head square. Antennæ long, seven-jointed, ochrous yellow, with black wings. Abdomen with a row, on each side, of small pores. Whole insect punctured. Legs dirty ochrous, with dark femora. Cauda black and hirsute, cornicles cylindrical. Size of body 0.055 inch. Winged female coloured much like the above. Wing voluminous, with a brownish membrane much punctured. Underside all brown. Rostrum reaching just beyond the third pair of coxæ. Expanse of wings 0.19 inch. Body 0.04 inch. These insects stain weak alcohol a fine port wine red colour."

Specimens of the rice sapper (*Leptocorisa acuta*, Thumb.) have been received from Mr. J. Cripps, of Chumparan, where the insect is said to have been very destructive to the ears of The Rice Sapper in Chumpan. *Bhuddai* paddy, which is harvested about October. The insects work chiefly on cloudy days and at night, and retire to the foot of the plants in hot sunshine. The cultivators are said to strew the fields with fresh buffalo dung, covered with buffalo buttermilk, in which an insect is said to breed

which attacks and destroys the Rice Sapper. The Rice Sapper occurs all over in India and attacks immature paddy grain in the ear, sometimes destroying a large proportion of the crop, especially when the rains set in early. Little is known of its life history.

In January 1890 were received from Mr. J. Cleghorn, Harnai, Baluchistan, a number of little cases formed of wheat grains cemented together. It is said that all granaries in Harnai have to be examined and cleaned every month to destroy the insect which constructs the cases, granaries not examined for three months having their whole contents destroyed by it. No specimens were received of the insect, but the cases appear to be the work of one of the *Tineinae* moths, which are cosmopolitan granary pests. The frequent examination required would seem to point to the insects passing through a number of generations in the year.

Mons. J. M. F. Bigot, to whom specimens of the Bashahr Grape Fly<sup>1</sup> were submitted for examination, writes from Paris that, though the specimens are insufficient for precise identification, the insect probably belongs to a new species of the genus *Drosophila*, which might be named *Drosophila apicata*.

Further specimens therefore should be procured for examination. In the meantime it may be noticed that the larvæ of other species of *Drosophila* attack both sound and decaying fruit. According to W. C. Fish, as quoted by Packard in his *Guide to the Study of Insects*, one species of *Drosophila*, which is known in the United States as the *Apple Fly*, attacks apples, rendering them unfit for use; in this case the maggot usually enters the apple through some wound caused by other insects, or, if there be no such wound, through the calyx. Many of the maggots arrive at maturity in August, and the fly soon afterwards appears, several generations being gone through before the cold weather, which the insect passes as a pupa in some sheltered spot, the flies emerging in the following spring.

From Messrs. Williamson and Magor were received in January 1891 caterpillars of a Limacodid moth, said to be Tea Limacodid. have proved injurious to tea in the Darrang district, Assam. The caterpillars defoliate the bushes and then descend to the ground, where they roll themselves into the characteristic Limacodid pupal case, resembling a minute potato. Children had been employed to hand-pick the caterpillars, but the numbers of the pest have been too great to be successfully dealt with in this way, and some inconvenience

<sup>1</sup> Vide page 202 of Vol. I, No. 4, of this serial.

was also found owing to the stinging properties of the bristles with which the caterpillars were armed. It is not thought likely that these caterpillars will occasion any very serious injury. The moths emerged on 26th January, and were forwarded to Colonel Swinhoe, who has determined them as belonging to a new species of *Miresa*, which he is describing under the name of *Miresa cotesi*.

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From Handerzai, situated at an elevation of about 4,000 feet in Baluchistan, Mr. Cleghorn sends an Œstrid Fly with the information that he has found it in November laying its eggs at the ends of the hair on horses' legs and other parts of the body that can be reached by the horse's mouth. Whilst laying its eggs the insect does not disturb the horse, but immediately afterwards irritation sets in, possibly from the itching caused by the frequent settling of the fly, and the horse bites the place where the eggs are laid, so that some of the eggs find their way into the animal's mouth, and thence into its stomach where they develop. Careful grooming and the application of a nose-bag to prevent the horse from biting off the eggs have been found to be the most practicable means of protecting the animal from the pest. The specimen was submitted for identification to Mons. J. M. F. Bigot, who reports that it is a variety of the well-known European form (*Gastrophilus equi*), which has been described under the name of *Œstrus bengalensis* (Macq., Dipt. Exot.). The life history of this insect is no doubt the same as that of the true *Gastrophilus equi*, which, according to Williston, lays four or five hundred eggs, generally on the inner side of the horse's knees, the horse showing great annoyance and often becoming unmanageable, though the insect can cause but little irritation in the process of laying its eggs. The eggs hatch a few days after they are laid, and the larvæ get taken in the horse's mouth when it is biting the irritated spots. They are then swallowed with the food, and, upon entering the stomach, attach themselves to the inner membrane by means of the hooklets that encircle the mouth. Here they remain for nine or ten months feeding on the suppurative matter produced by the irritation they set up within the stomach, and when full-fed they loosen their hold and are carried through the intestinal canal and ejected with the excrement. They then burrow into the ground and transform into pupæ, from which the imagoes emerge in thirty or forty days. When only a few grubs are present in a horse's stomach they are said to cause but little injury to the animal, but when they exist in large numbers they may produce sufficient inflammation or loss of blood, in some cases even to cause death.

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Through the Calcutta Agri-Horticultural Society was received in November 1890 a specimen of the Dynastinid beetle *Xylotrupes gideon*, var. *mniszechi* (?), said to have caused some damage by eating the pulp of coffee fruit in Cachar.

From Mr. R. Wroughton, of Poona, have been received specimens of the Liparid moth, *Artaxa limbata*, with the information that the caterpillars were injurious to young grafted mango plants. The insect had been reared by Mr. Wroughton, who noted that the caterpillars were found on 23rd September, the cocoons spun on 29th September, and the moths emerged about 12th October.

The Acridid grasshopper *Phymatæus miliaris*, which may perhaps be the locust that proved destructive to crops in Nowgong in 1879, is noted by General H. Collett as fairly common in the neighbourhood of Shillong, where it is often to be seen feeding on bushes and grass, though it is thought not to do any appreciable damage to the crops.

Through the Calcutta Agri-Horticultural Society were received in June 1890 a series of mangoes from Mozafferpoore, where they are known as *Lal kampee* and are said to be attacked, very generally throughout the district, by white maggots. These maggots are about the size of grains of rice, and are found in such numbers in the fruit as to render it unfit for use. The maggots are likely to be the larvæ of some dipterous insect allied to the species (*Rivellia persicæ*) described on page 192 of Vol. I of these Notes as destructive to peaches in Chota Nagpore; but for some unexplained reason the mangoes actually received were found to be unaffected by anything of the kind. The only insect discovered in them, after careful search, was the solitary larva of a micro-lepidopterous insect which was about three-sixteenths of an inch long by one thirty-second of an inch thick. It had bored a hole in the side of the mango, but had not penetrated more than about a quarter of an inch into the pulp. It may, possibly, have been the caterpillar of the moth (*Maruca* nov. sp., Swinhoe) which has been found boring into the stones of mangoes in Calcutta. Its position shows that it was in all probability hatched from an egg laid by the parent moth in the skin of the nearly ripe fruit.

The following information has been furnished by Mr. G. Rogers, of the Forest Department, in Darjiling. In April 1890 a blackish, hair-covered, processional caterpillar, about two inches in length, defo-

Notes from Darjiling forests.

liated the *Buk* (*Quercus lamellosa*) trees over an area of about twelve miles long by eight miles broad, near Darjiling, the trees, which were in some cases as much as seventy feet high, being often completely denuded of their leaves. Much injury was not done however, as, at the time that the caterpillar appeared, the trees had only their last year's leaves upon them, while they put forth young leaves again in the following June. The *Sungare katus* (*Quercus pachyphylla*), a valuable forest tree which grows in Sikkim at an elevation of 7,000 to 10,000 feet, suffers from the attack of the larvæ of one of the Curculionidæ beetles, which is estimated to destroy 90 per cent. of the seed. The only specimens that could be obtained were small grubs, about a quarter of an inch in length, and of the characteristic curculionid shape; they are insufficient for precise identification.

A large swift-flying Curculionid beetle, which has been identified as *Cyrtotrachelus duw*, and which, in the male, is characterised by enormously developed front legs, attacks the asparagus-like shoot of the hill bamboo *Dendrocalamus hamiltonii* at elevations of about 3,000 feet above sea-level. In May and June the imago is often found clinging on to the growing shoot, which is perforated by a big hole from which it has emerged. Shoots thus attacked come to nothing.

In June a large green Rutelinid beetle, which has been identified as *Anomala viridis*, strips leaves off the *Al* tree (*Alnus nipalensis*), growing at elevations of from five to six thousand feet above sea-level.

A Stag beetle, which has been identified as *Lucanus mearesi* of Hope, bores into the dead sapwood of the *Kharani* tree (*Symplocos*, sp.) at elevations of between five and six thousand feet above sea-level.

A large wasp, which has been identified as *Vespa magnifica*, builds a nest sometimes two feet in diameter in the trunk of a laurel known locally as *Kawlee*. The nest occupies the whole of the interior of rotten trees, and is to be found in July at elevations of about 6,500 feet. The hill people are in the habit of eating the grubs of this wasp, though the sting of the imago is so severe that an Englishman has been known to have nearly died after being stung by three of them.

The wild bee, *Apis dorsata*, is not often noticed at elevations above two thousand feet, though in one place a large bee which probably belongs to this species builds combs on the face of some rocks at an elevation of four or five thousand feet, and yields, in good years, a revenue of as much as a hundred rupees to the Forest Department.

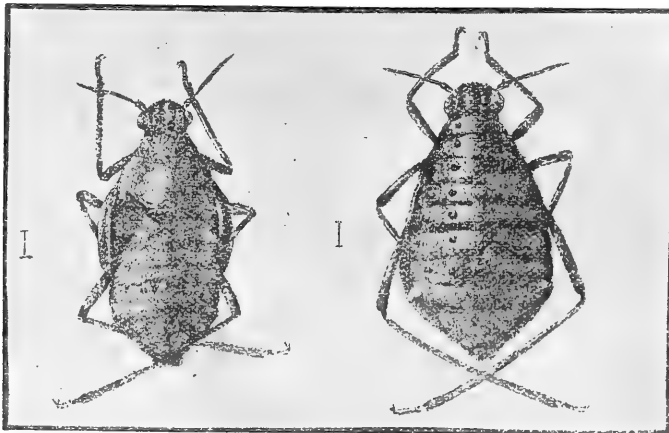
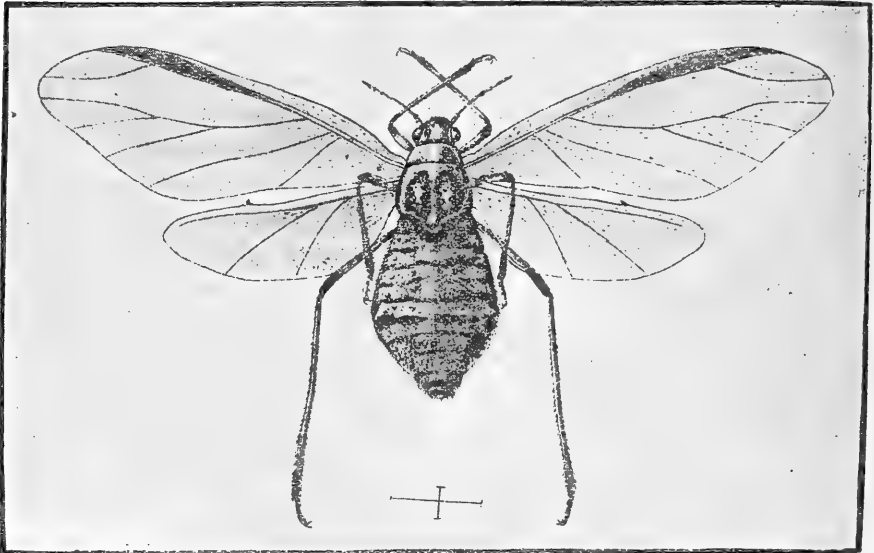
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From the Bhergaon garden, Mungledye district, Assam, were received

*Flata conspersa* on tea. In October 1890, through Messrs. Williamson and Magor, tea shoots attacked by the larvæ of the homopterous insect *Flata conspersa*, which had covered the shoots with its characteristic white secretion and was said to be feeding

on the bushes and retarding the flushes, the whole garden being badly attacked by it. A closely allied insect was once before sent to the Museum as attacking tea, but as nothing further was heard of it the supposition is that it did not occasion any very considerable damage. This is also likely to be the case in the present instance.

Specimens of one of the Aphidæ have been received from Mr. C. F. Elliot, the Deputy Conservator of Forests, Baluchistan Fruit Tree Aphid. Quetta, Baluchistan, with the information



that they infest apricot, almond, and peach trees, swarming in patches from six inches to a foot in length on the undersides of the branches, especially of the apricot, and causing the trees to bleed profusely.

The wingless forms were noticed from March onwards, and in the early summer they were so numerous that it was found worth while to have them rubbed off daily by hand. Winged individuals were found for a short time in October, eggs and young appearing on a few trees in the latter part of November, a fortnight's rainy weather in November not appearing to affect them. This insect has not been previously recorded as attacking fruit-trees in Baluchistan, though it may not improbably be the same as what has been noticed by Mr. Cleghorn as causing the bleeding of poplar trees in that region. Specimens were sent to Mr. G. B. Buckton, who has determined the insect as a new species of *Lachnus* which he describes as *Lachnus fuliginosus*. The report which he has kindly furnished upon the insect is as follows:—

“The specimens embraced the three different stages of larvæ, pupæ, and a few winged examples of viviparous females. These insects clearly belong to the *Lachninae*, or Aphides, which show the full number of nervures in their upper and lower wings, possess short six-jointed antennæ and thick mammilliform nectaries or cornicles.

“The Quetta insects do not exactly agree with any described species of *Lachnus* with which I am acquainted.....I may mention that, as a rule, the European *Lachninae* feed upon conifers, but not exclusively, for an *Aphis*, very like the one under examination, viz. *Lachnus viminalis*, feeds on the willow bark. Hitherto the plum, the peach, and the apple tree have not been recorded as liable to the attacks of these insects of the genus *Lachnus*. Several important differences, as will appear by the following diagnoses, lead me to suppose this to be a new species, notwithstanding certain resemblances to the willow *Lachnus* before mentioned. Provisionally I name this Quetta insect *Lachnus fuliginosus*, nov. sp.

“*Larva*.—Variable in shape according to age; either long-oval or globose. Head small, vertical edge round. Eyes, small. Thorax separated from the abdomen by a slight stricture. Antenna rather short, stout, and hirsute, six-jointed, the nail being counted as one. Abdomen rugose, and studded with black shining tubercles. Nectaries stout and mammilliform. Apex of abdomen round, hirsute, and without a visible cauda. Legs long, yellow, with black points to the femora and tibiæ. Tarsi black and two-jointed. Rostrum one-third the length of the body. Length 0.16 × 0.09 inch = 4.0 × 2.2 millimetres. Antenna 0.05 inch = 1.27 mil.

“*Pupa*.—More linear in form, but much of the same colour as the larva. On the somite preceding that on which the cornicles are developed, a curious horn-like process rises, out of the dorsum. In *Lachnus viminalis* this horn appears to be restricted to the larval stage. The wing-cases are about equal to one-third the length of the body.

“*Imago*.—Viviparous female. Head small; vertex rounded, and finely pilose. Antennæ black, and fringed with hair; about half the length of the body; with two stout basal joints; the first of which is rather the longest; the third joint the longest of all. The fourth and fifth about equal length; the fourth sometimes shows a constriction or a tendency to subdivide. The nail-like process on the sixth is sometimes so large as to suggest the antennæ to consist of seven joints instead of the normal number of six. Eyes moderately large, and apparently without any supplemental eyelet.

Thorax broad, with two alar muscular bosses. Scutellum small, abdomen pilose, brownish grey, flask-shaped, and much corrugated. Nectaries as in the larval condition. Abdominal apex rounded, fringed with hair, and without a cauda. Legs long, particularly the hinder pair; second tarsal joint the longest, and furnished with two black claws. Wings one-third longer than the body; membrane semi-transparent smoky-brown, densely and finely punctured. Stigma long and straight. Stigmatic vein nearly straight. Cubital vein twice forked; other veins as in *Lachnus*. Lower wing with two straight cubital veins. Expanse 0.54 inch or 13.7 millimetres. Size 0.17 × 0.80 inch or 4.24 × 2.02 millimetres.

"It would be hazardous to describe the colours of the living insects from samples preserved in spirit, but it may be fairly assumed that the colours are of a grey-brown or black, with a few obscure spots on the sides and dorsum. When placed in spirit, they yield to it a deep port wine red tint, and the same stain tinges the insects mounted in Canada balsam."

In September 1890 were received, from the Agricultural Department, Paddy caterpillars in Bhamo. Rangoon, pupæ of a moth belonging to the family *Limacodidae*, said to have proved destructive to paddy in part of the Bhamo district. The specimens were insufficient for precise identification.

From the Sub-Manager of the Encumbered Estates, Ranchi, were received in September 1890 a number of hair-covered caterpillars probably belonging to the heterocerous family *Lasiocampidae*, but in too poor condition for precise identification. They were said to attack *Dhan* and *Marua* crops in Lohardugga, the damage annually done by the insect in one pergunnah being estimated at from four to six annas of the total crop. The caterpillars appear in the rainy season and defoliate the plants, trenches being dug by the cultivators to prevent their passing from the upland crops to attack the rice which lies at a lower level.

The Executive Commissariat Officer at Thayetmyo reports that the Ants attacking potatoes. outturn of potatoes grown from English seed in the Commissariat garden in 1889-90 was considerably reduced by the ravages of a small ant which attacked the tubers when quite young. No specimens have been furnished, but, according to Dr. Walsh, the insect may perhaps have been the common red ant *Solenopsis gemminata*. The only remedy suggested is that of following the ants to their nest and destroying them there with boiling water, kerosene oil, or bisulphide of carbon.

In October 1890 the Collector of South Arcot reported injury to Paddy pest in South Arcot. paddy in his district by caterpillars. Specimens of the caterpillars were forwarded



through the Board of Revenue and the Government Central Museum, Madras, and were found to be the larvæ of a Noctues moth which is probably one of the Leucaniidæ or Heliothidæ. The material, however, was insufficient for precise identification. The injury done by the insect appears to have been slight.

The following is an abstract of a series of Notes on Mosquito blight (*Helopeltis theiovora*) furnished by Mr. C. Mosquito blight in Darjiling. N. Harcourt, of the Ging factory, Darjiling. For a more detailed account of the insect *vide* page 180 of Vol. I of this serial. *Helopeltis theiovora* injures tea both in spring and also during September; it attacks chiefly the young tea shoots, also fuchsias, and a tree (*Schima wallichii*), known locally as *chilauni*, which is botanically allied to the tea-plant. The blight does not ascend above an elevation of about 4,500 feet, and most of the damage is done in the Terai, tea planted on black sandy soil appearing to be particularly attacked. Gardens are often affected to the extent of closing the crop earlier than usual and considerably lessening the outturn, but precise estimates of the amount of loss occasioned in the Darjiling tea district are not available. The insect punctures the epidermis of the young tea leaf, with its proboscis, and sucks up a little of the sap, leaving a round transparent spot wherever it has been at work, and it seems to have some poisoning effect, as the buds, below an affected leaf, dry and fall off as if burnt. The eggs are laid in the soft stems of the tea shoots, and can only be discovered from the three small hairs which are attached to each egg and which protrude from where it lies. The eggs are about one thirty-second of an inch in length and very slender. When first laid they are hard and white in colour, but they become red before hatching. The larva becomes full grown in about a week after emerging from the egg; it has the characteristic bug-like odour, and the only animal noticed to attack it is a small spider.

From the Officiating Commissioner of Settlements and Agriculture, Central Provinces, were received in July 1890, caterpillars of Bombyces moths said to be in the habit of destroying paddy in Sambalpur. The material was insufficient for the precise identification of the insect concerned.

In February 1890 were received from Mr. John Guilt, of Darjiling, caterpillars of the Bombyces moth. *Olene mendosa*, Hübn. They were said to feed on tea bushes.

From the Deputy Conservator of Forests, Kamrup division, Assam, have been received pupæ of a Bombycid moth, probably belonging to the family *Liparidæ*, said to have suddenly appeared in vast swarms and denuded *sal* trees in the Kulsi range of their leaves. This particular caterpillar had not been noticed previously, and the natives attributed the visitation to the successful protection of the forest against fire. Pupæ were found in the end of October 1889. Moths appeared immediately afterwards and laid eggs which produced caterpillars in the beginning of November, after which the pest seems to have disappeared for some time, moths and caterpillars, however, being again noticed in large numbers in the middle of December. Several attempts were made to rear the pupæ in Calcutta to enable the identity of the moth to be ascertained, but the only insects that emerged were Tachinid and Hymenopterous parasites, with which the pupæ seem to have been very much infested.

The Superintendent of the Government Horticultural gardens in Lucknow, in February 1890, forwarded larvæ of a moth, probably belonging to the family *Hepialidæ*, said to be commonly found in the stems of fruit-trees, such as oranges and guavas, which it injures to a serious extent. Mustard oil poured into the hole was found to kill the insect. Specimens either of the moth into which these caterpillars transform, or live pupæ, which no doubt are to be found in the tunnels, are desired to enable the insect to be precisely determined.

In February 1890 were received, through the Agricultural Department of Madras, specimens of cotton plants said to be attacked by plant lice (*Aphidæ*) which caused the decay of the plants. The specimens were insufficient for any conclusive examination, and the only Arthropoda that were found on them were a number of mites which are not thought to have been connected with the destruction of the plants.

Injury was reported by Baboo T. N. Mukharji to have been done to musk mallow and cabbages cultivated by the Cossipore Agricultural Society in August 1889, by an insect which proved to be *Dysdercus cingulatus*, Fabr. (Heteroptera, Lygæidæ), noticed on page 127 of Vol. I of this serial. The insects were said to have fed upon the leaves and afterwards to have taken up their abode within the capsules of the musk mallow fruit.

Through the Madras Museum were received in January 1890 specimens of (1) the Buprestid beetle, *Psiloptera fastuosa*, Fabricius, and (2) heterocerous larvæ, probably belonging to the family *Hepialidæ*, both said to injure the Government teak plantations in Nilambur, Malabar.

With regard to the species described on page 80 of Vol. I of these *Notes*, by Professor Kohl, as *Chalcis criculæ*, Mr. W. F. Kirby, of the British Museum, suggests that the species may, perhaps, be identical with the *Chalcis responsata* described by Walker in Tr. E. Soc., Lond. (3) I, page 355 (1862), from North India. He notices that this species has hind tibiæ "white, with the inside of the curve black." An examination of the type specimens of *Chalcis circulæ* in the collection of the Indian Museum shows that the hind tibiæ are yellow, with a very thin black line along the inside of the curve. This seems to point to the probable correctness of Mr. Kirby's supposition, white colour on the tibiæ being very likely to show as yellow in old specimens.

Some larvæ of a Scarabæid beetle, probably one of the Cetoniini, were received in December 1890 from Mr. F. J. V. Minchin, of Ganjam, with the information that they cut the branches, and even the stems of young Casuarina trees across diagonally, as one would cut a stick with a knife. The insect cannot be precisely determined without an examination of the imago; and the observation would seem to require explanation.

In July 1887 were received specimens in various stages of development of the Coccinellid beetle, *Epilachna vigintioctopunctata*, Fabr. var., from Burdwan, where it was said to feed upon the brinjal plant, whole fields in Burdwan being sometimes destroyed by it. It was thought at the time that some mistake had probably arisen in this observation, the Coccinellidæ generally being carnivorous, but observations since made in Dehra Dun, North-Western Provinces, where the imago was found feeding on a cucurbitaceous plant, point to this species being an exception to the general rule.

In January 1890 the Deputy Commissioner of Umballa forwarded, through the Director of Land Records and Agriculture, Punjab, the following insects:—  
 Umballa pests.  
 (1) immature larvæ of a Bombyces moth, said to attack rapeseed;  
 (2) coleopterous larvæ said to attack sugarcane; the specimens being

in both cases in too poor a state of preservation for precise identification ; (3) the common acridid grasshopper (*Chrotogonus*, sp.) said to do considerable injury to wheat, barley, linseed, and rapeseed, appearing in June or July and dying off about December, no means being known of destroying it ; (4) caterpillars of the butterfly, *Mancipium nepalensis*, Grey (Rhopalocera, Pierinæ), said to attack gram, *Toria*, linseed, sugarcane and garden vegetables, such as radishes, the only known preventive being ashes, which, in some cases, are thrown over the plants.

From the agent of the Lyall Farm, Budaon, have been received ;—(1) caterpillars of a Noctues moth said to attack rabi crops, such as mustard, barley, safflower, and wheat ; (2) an Acridid grasshopper belonging to the genus, *Chrotogonus*, said to have done such extensive injury to indigo as to have seriously interfered with the cultivation and manufacture of the drug in the district. The grasshopper appears in April and May in large numbers in the indigo fields, and destroys the young plants by biting them off as soon as they appear above the ground ; it continues to be found in large numbers up to the end of August, and gradually disappears about November. When the rainfall is deficient in July, it also does much injury to kharif crops, such as Mash (*Phaseolus radiatus*), Bajra (*Penicillaria spicata*), Til (*Sesamum indicum*), and Lobia (*Vigna catiung*).

From the Settlement Officer, Koojang estate, Orissa, were received, in February 1890, Noctues caterpillars known locally as *Kala mundi*, and said often to do much injury to rabi crops growing on tracts subject to inundation, sometimes also attacking rice. The insect appears on rabi crops in the early part of the cold weather, and spins a web over the leaves and flowers ; it feeds chiefly on the flowers and disappears as soon as these die off. Specimens submitted for examination prove to be the caterpillars of a Noctues moth, which cannot at present be precisely determined without an examination of the moth. Specimens therefore either of the moth itself or of the live chrysalides, which can be reared in the Museum, should be furnished.

The Settlement Officer also reports that in 1887 insects much like locusts, but green in colour, with longitudinal black stripes, appeared just after the flowering season of the paddy, and did great damage to the crop by cutting off the ears, the outturn being said to have been diminished by about half.

The Collector of Hooghly reports (letter dated 12th February 1891) much mischief to the mustard crop by an insect which proves to be one of the *Aphidæ*

Hooghly pests.

(plant lice). The specimens have been forwarded to Europe for identification, as they are unrepresented in the Museum collection. He also notices that wheat is attacked by one of the Lady-bird insects (*Coccinellidæ*).

In December 1890, from the Overseer of the Government Farm,

Nagpur pests.

Nagpur, were received—(1) *Bombyces caterpillars*, probably belonging to the species

*Spilosoma suffusa* of Walker; these were said to have attacked the *Til* crop (*Sesamum indicum*), as many as thirty caterpillars being sometimes found upon a single leaf; the same insect was said in the rains to defoliate plantains and *San-hemp* (*Crotalaria juncea*), thence spreading over the neighbouring foliage plants of all kinds. (2) Pods of the *Popat* plant (*Lablab vulgaris* = *Dolichos lablab*) tunneled by the larvæ of a minute Plume moth said to be known locally as *Mekada*; a note on this insect will be found on p. 19. (3) Noctues caterpillars thought to belong to the genus *Leucania*, found boring into the pods of *Tur* (*Cajanus indicus*), the seeds of which they destroy. The injury caused by the three foregoing insects is reported to have occurred owing to the cloudy weather which prevailed for about a week without rain, and was then followed by plentiful rain, which was expected to kill off the insects, and thus prevent further damage.

From the District Engineer, Patna district, were received, in February

Patna pests.

1890, larvæ of the Noctues moth, *Heliothis armigera*, and of a Geometres moth, for the

precise identification of which specimens of the imago are required. These insects are reported to attack *Khessari* pods in the months of January and February.

The following is a report by the Officiating Collector of Monghyr

Monghyr pests.

on insect pests in his district:—

"In this report are embodied the results of the enquiries made by the Sub-divisional Officer for the sub-divisions and the Sub-Deputy Collector for the sudder sub-division. Several zemindars, &c., in this district were also requested to furnish any information they could regarding the damage insects do to different crops, and to send specimens of such insects, live or dead, but none of them seem to have taken any interest in the matter yet.

"The species of insects which are most injurious are—

"*Gudhiya*.—A small fat grasshopper of about an inch and a quarter long and three-eighths to half an inch broad and quarter inch high, of a dull white colour. The eggs are hatched and the young insects born in May and June. They at once look out for all the young and tender plants just germinating at that time with the early showers prior to the regular rainy season. When this pest attacks a field it eats up either the whole field or a portion of it in patches. It frequently affects a whole village to the extent of about 25 per cent. of its yield.

"The *wheat Keery* (Larka) is a small, soft, round, green caterpillar. An insect of about one and a-half inch long and one-fifth of an inch in diameter. It is found usually near the roots of the young wheat plants which it eats right through. It makes its appearance in November and disappears when the plants are somewhat developed.

"The *oil seed Keery* (Lahi) are small insects. They devour the oil seed in its early stage. The produce of a village is often affected by them to about 30 per cent. They appear when the rains cease and there is still moisture in the fields.

"*Bhooa* is an insect about two inches long and quarter inch in diameter with a thick covering of mixed white and black hairs about quarter inch long. It appears just after the oil seed Keery (*Lahi*). The damage done by this insect is often 15 per cent. of the wheat crop.

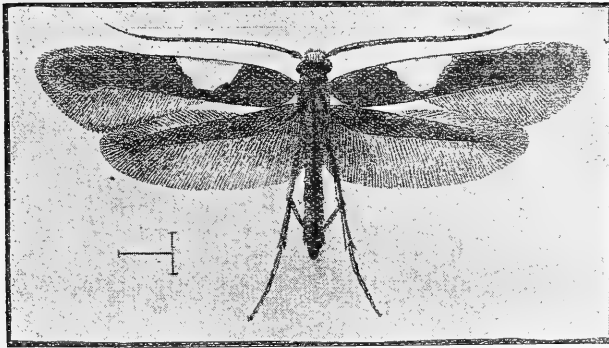
"Besides the above, there is a species of small insect called *Kujra* which cuts off the ears of the paddy crop and eats up the rabi crops also.

"The subject will be given more close attention to during the next autumn, winter, and summer harvest seasons, and more information will be collected and better specimens of insect pests obtained and sent to the Indian Museum."

II.—A NEW SPECIES OF *TINEIDÆ*.

(*Gracilaria theivora*, Wlsm., sp. nov.)

By LORD WALSINGHAM, F.R.S.



*Antennæ*, steel-grey, each joint spotted above with purple, basal joint slightly enlarged, purplish.

*Labial palpi*, ochreous, the apical joint tipped with fuscous beneath.

*Maxillary palpi*, yellow.

*Head*, shining grey above, posteriorly iridescent purple: face shining yellow.

*Thorax and patagia*, iridescent purplish cupreous.

*Fore wings*, narrow, elongated, pointed, with rounded cilia; brilliant shining purplish cupreous, with a series of slightly darker and ill-defined streaklets along the dorsal margin from the base to the apex: a brilliant shining yellow triangular costal patch commences at one-fourth from the base and reaches to the middle of the wing, its apex is obtusely truncate before reaching the dorsal margin; cilia brownish grey, with a paler line near their base. Under side, greyish-fuscous.

*Hind wings*, greyish-fuscous; cilia steel-grey, with a slight iridescent lustre. Under side, greyish fuscous.

*Abdomen*, greyish above, shining yellow beneath.

*Legs, anterior*,—purplish fuscous, tarsi shining white, spotted above at the joints with fuscous; *posterior*,—greyish fuscous above, tarsi inclining to ochreous, dark spotted above at the joints, spurs ochreous.

*Exp. al.* 13½ mm.

*Larva.* Mining leaves of the tea-tree.<sup>1</sup>

*Hab.* Ceylon (Pandaloya).

*Type* ♂ ♀ *Mus. Wlsm.*

I have received two specimens of this very beautiful, brilliant and distinct species from Mr. E. C. Cotes ; they were bred by Mr. Green from larvæ mining the leaves of the tea-tree (presumably *Camellia theifera*), but it will probably be found to feed on other species of *Camellia*. The nearest allies of this species are the North American *blandella*, Z. and *belfrageella*, Chamb.

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<sup>1</sup> According to the account of this insect given by Mr. E. E. Green in the Ceylon *Independent*, the egg is laid on the under side of a young leaf, generally on a young bush. On the hatching of the egg, the young caterpillar mines the leaf, the mine being visible on the under side only, and terminating in a small pocket formed by the folding over of the edge of the leaf. Here the caterpillar sheds its skin, and, this done, it proceeds to roll the leaf together, so as to form a shelter in which it lives for the remainder of its larval life, feeding upon the substance of the leaf. When full fed, it is about three-eighths of an inch in length, and yellowish or greenish in colour, with a few short bristles scattered over its body. The chrysalis is formed in a flat silken cocoon on the leaf, the pupal stage lasting about two weeks. The caterpillar is attacked by minute Ichneumonidæ, besides being often drowned in wet weather by the water that accumulates in the rolled-up leaf.—*E. C. C.*



## III.—THE BALUCHISTAN MELON FLY.

( *Carpomyia Pardalina*, ♂ et ♀, nov. sp.).

By J. M. F. BIGOT.

Long. ♂ = 4 mill. et  $\frac{1}{2}$ ; ♀ = 5 mill. et  $\frac{1}{2}$  (cum oviducto).

♂.—*Oculis aeneis; capite fulvido; antennis, palpis, haustello ejusdem coloris; chæto antennale nigro, basi albidâ; macrochætis cunctis nigris; thorace pallide flavido, retrorsum albescente, tergo, ante, angustissime fulvo bilineato, utrinque nigro nitido trinitato, et retro pariter unimaculato; scutello albescente, nigro nitido quadrimotato; halteribus, abdomine, pedibusque totis, pallide fulvis, femoribus anticis sat incrassatis, interne fuscopilosulis; alis hyalinis, transverse, late, fulvopallido trivittatis, vitta apicale bifida, vittis cunctis cinereo obscuro anguste marginatis.*—  
♀ *simillima; oviducto abbreviato, fulvido.*

♂.—Les yeux d'un vert brouzé brillant; tête d'un faune pâle, ainsi que les antennes, les palpes et la pipette; tous les macrochètes noirs; chète antennal noir à base blanche; thorax d'un faune pâle; tergum, avec, en avant, deux lignes rougeâtres très étroites, en arrière, largement blanchâtre, ainsi que l'écusson, de chaque côté, quatre grandes macules arrondies saillantes, d'un noir luisant, les plus grandes situées en arrière; écusson avec trois grandes macules situées sur les côtés, et une petite tache médiane, toutes semblables; les macrochètes noirs; abdomen, pieds, entièrement d'un faune pâle, base des segments légèrement pruinoux; les fémurs antérieurs assez notablement renflés, avec quelques poils brunâtres en dessous; ailes hyalines avec trois larges bandes transversales faunes, celle située à l'extrémité, se bifurquant en forme de V, dont la branche extérieure contourne le bout du disque, toutes ces bandes marginées d'une nuance grisâtre, principalement la branche qui borde l'extrémité de l'aile.—♀ Semblable au ♂; l'oviducte court, obtus, rougeâtre.

Plusieurs spécimens ♂ et ♀. Beloutchistan.

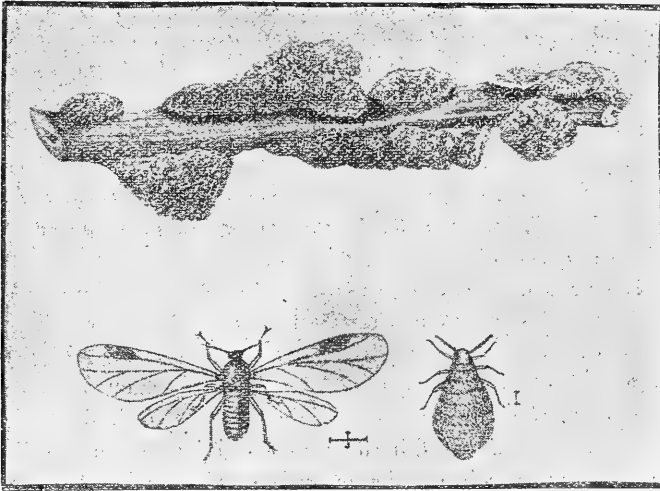
Attaque les *Melons*. Larve, cylindroïde, allongée, légèrement atténué aux extrémités, teinte d'un jaune pâle et luisant, les anneaux fort peu marqués, deux petits crochets noirs à l'une des extrémités; long. = 11 millim.

Cette remarquable espèce, incontestablement inédite au présent jour, appartient, sans aucun doute, au genre *Carpomyia* (Rondani), inscrit par l'auteur dans son groupe des *Tephritoidi* (vide *Bullet. della Sec. Entomol. Italiano, Vol. III, Fasc 2, 1871, Firenze*).

IV.—AMERICAN BLIGHT<sup>1</sup> (*Schizoneura lanigera*).

By E. T. ATKINSON.

The insect so well known in England as "American Blight," in America as "Woolly Aphis of the apple," in France as "Puceron lanigère," in Germany as "Blutlaus," has appeared in India and done considerable



damage to orchards in Conoor and Bangalore. It belongs to the order *Rhyncho*, suborder *Homoptera*, family *Aphidæ*, and genus *Schizoneura*, and appears under two conditions, one attacking the branches and trunk, the other the roots. In both cases its presence is readily detected by the abnormal growth of gall-like excrescences or knobs on the parts affected, leading eventually, in many cases, to the death of the tree. During 1888 it was particularly common in England, where much attention has been paid to devising remedies against it.

The aerial form is usually found about the base of twigs or of suckers springing from the trunk, or the base of the trunk itself, and in wounds and crevices of the bark. In autumn they are said to be found abundantly in the axils of the leaf-buds, towards the ends of the twigs, and are easily recognised by the white downy tomentum by which they are covered. Under each patch of down there is usually found a female

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<sup>1</sup> The following paper was written shortly before Mr. Atkinson's death. The delay in publishing it has been due to the preparation of the figures by the Museum artist. The winged insect is copied from a figure which has appeared in American and English works on the subject. The larva and the galls are from specimens furnished by Mr. Daly.

with her young. These insects are capable of bearing extreme cold, and it would appear that where they hibernate in the open bark, their downy covering increases much in quantity.

#### SCHIZONEURA LANIGERA.

(*Aphis*), Hausmann. Illiger's Mag. Insekt., i, 1802, p. 440; Banks, Hort. Soc. Trans., ii, p. 162, t. 11; Kirby & Spence, Introd. Ent., 5 ed., 1828, i, p. 29, 200; ii, p. 225; iii, p. 182: Hints on Orchards, Salisbury, 1816, p. 39: Andouin, Ann. Soc. Ent. Fr., iv, p. 9. App.: Goureau, Bull. Soc. Ent. Fr. (2 s.) x. 1852, p. lxxix.

(*Schizoneura*) Hartig, Germar's zeitschr. Ent., iii, 1841, p. 367: Kaltenbach, Mon. Pflanzen, i, p. 169: Walker, Cat. Hom., iv, p. 1048: Buckton, Aphides, iii, p. 89, t. 105, 106: Saunders, Insects injurious to Fruits, 1883, p. 13, 27, f. 1, 13, 14.

(*Eriosoma*). *Ruricola* (Curtis), Gardener's Chronicle, iv, Feb. 1844, p. 116, f. 1—3: Glover, Rep. Dep. Agric., Unit. States, 1877, p. 38, f. 41.

*Mali*, Coccus, Bingley, Anim. Biogr., iii, 1803, p. 200: (*Eriosoma*), Samouelle, Compend., i, 1819, p. 16: Mosley, Gardener's Chronicle, i, p. 828: (*Myzoxylus*), Blot, Mem. Soc. Linn. Calvados, i, 1824, p. 114; *id.*, Mem. Soc. Agric. Caen, 1830, p. 58: Am. and Serv., Hist. Nat. Ins. Hem., 1844, p. 612: Tougard, Ann. Soc. Hort. Paris, xiv, p. 341.

*Pyri* (*Eriosoma*), Fitch, The Senate, 30, 1851, p. 68: (*Schizoneura*); Walker, Cat. Hom., iv, p. 1052; Suppl., p. 302: (*Pemphigus*), Fitch, Fourth Rep. N. Y. State Cab. N. H., 1851, p. 68: Walsh, Proc. Ent. Soc. Philad., i, 1866; *id.*, Practical Entomologist, 1866: Glover, Rep. Dept. Agric. Unit. States 1879, p. 38: Riley, Bull. Unit. States Ent. Com., vi, 1881, p. 59.

*Trunk and branch-inhabiting form.*—Hausmann describes the form of the first generation as having the body oval and strongly domed: head, eyes, antennæ, rostrum and legs blackish; thorax and abdomen deep honey colour, shining, the latter covered with woolly whitish down. The form of the second generation is winged, somewhat smaller and narrower than that of the first generation, and a second form of the second generation differs in size and its lighter colour. M. Goureau, quoted by Thomas, describes the stages thus:—

"*Apterous individuals*.—About one-tenth of an inch long; reddish brown and covered above with a white, cottony secretion; antennæ short and pale yellow; legs yellowish; knees brown; without honey-tubes, but with a circular cicatrix in place of them.

"*Winged individuals.*—Antennæ shorter than the head and thorax, and varying in colour from brown to black; head and thorax black, a brownish ring at

the collar; the abdomen chocolate-brown; legs brownish; wings hyaline, with the veins and stigma deep brown; body enveloped in a white cottony secretion."

Through the labours of Lichtenstein, however, we are able, in some measure, to trace the successive changes through which this insect passes. From the single egg of each female of the last stage comes an apterous so called female (*Pseudogyne* of Lichtenstein) or 'Queen Aphis' (also called *Stammütter*, *Altmütter*, *Fundatrix*, *Pseudogyne fondatrice*), which becomes the founder of the colony, forms the gall, and after a number of moults fills the gall with its progeny.

Buckton describes this 'Queen Aphis' thus—

"Size of body,  $\cdot 07 \times \cdot 055$  inch;  $1\cdot 77 \times 1\cdot 39$  mill.: length of antennæ,  $\cdot 015$  inch;  $0\cdot 38$  mill.: colour dark shining brown, approaching to black: form oval, flat and ridged: dorsum domed and deeply marked with sutures; eyes very small: antennæ and legs very short, black or reddish: nectaries represented by pale papillæ with a median spot: cauda rudimentary: body sparingly covered with a cottony tomentum, which is most developed at the caudal extremity: rostrum very short, only reaching the second pair of feet. The progeny of the Queen Aphis differs much in size and form from their parent. They are of various shades of red or warm brown, and are less flattened and longer in the body. When just produced, the rostrum is very long, extending far beyond the body, but ceases to grow, whilst the insect itself rapidly increases in size and eventually exudes from its pores long silky threads, which form a covering. After their moults the progeny of the Queen Aphis reaches the second larval state, called the 'Emigrant winged<sup>1</sup> Pseudogynes' by Lichtenstein, when they leave the galls and fly to some other food-plant and deposit small lice, which form the *Gemmantia*, or third larval state, (the whole brood being capable of reproducing their species without any connection with a male by a process of germination or budding forth without being enveloped in a pellicle or pseudovum, as observed by Lichtenstein) This is the curious stage of unlimited apterous reproduction, very much like that observed in the case of the well-known *Phylloxera vastatrix* (vine pest). Out of the numerous colonies formed arises the winged viviparous females (pupiferous of Lichtenstein), forming the fourth larval state, which carry back to the parent tree the pupa from which issue small apterous male and female lice. The latter after copulation lays the single egg from which the Queen Aphis arises and another cycle commences.<sup>2</sup>"

Buckton describes the winged viviparous female thus:—"Expanse of

<sup>1</sup> In Ent. M. M., November 1878, p. 135, Lichtenstein observes that the emigrant, or second larval form of *Schizoneura lanigera*, is wingless.—E. C. C.

<sup>2</sup> These stages represent the ascertained facts chiefly in the case of *Aploneura lentisci*, Pass.

wings, 0.2 inch; 5.08 mill.: size of body, .05 × .025 inch; 1.27 × .62 mill.: length of antennæ, .025 inch; .62 mill. Uniform colour dusky brown, approaching to black: pronotum rather paler, abdomen carinated and ringed: antennæ short; third joint long and strongly ringed, the three following joints less markedly so: wings ample and rounded at their apices; membrane smoky and slightly punctured: cubitus broad, ending with a large trapezoidal brown stigma: veins black, cubital vein with a single furcation: legs short. The small sexuated lice produced by this female appear to be born within a pseudovum. They have no rostrum, which is represented by aborted buccal processes, its five-jointed antennæ and the tarsi also are not well developed; the eyes are small and the colour of the ♀ is yellow, tinged with red. The length of the ♀ is 0.63 mill., and of the ♂ 0.50 mill. The fact that both male and female in this stage are without the usual sucking organ shows that they exist simply for the propagation of the species, and when that is accomplished, they perish."

*Root inhabiting form.*—Thomas describes the root-inhabiting form called *Pemphigus pyri* by Fitch thus:—"The young larvæ are scarcely 0.04 inch long, of an oval form, and pale dull yellow colour: legs short, robust and nearly equal in length: the antennæ appear much like a fourth pair of legs and are five-jointed. From the extremity of the abdomen usually appears a white filament of flocculent, cotton-like matter \* \* \*."

*Winged individuals.*—These are nearly quarter of an inch long to the tips of the closed wings; body, legs and antennæ, coal black; the head and abdomen above covered with cottony down: fore wings transparent and slightly smoky, as though sprinkled with fine dust; veins black; the third vein is rather more slender than the first, nearly straight, not forked, its basal third abortive; stigma dark, smoky brown, oblong; its opposite sides nearly parallel, abruptly conveying to an acute point at each end: hind wings clearer; the two discoidal veins, black. The winged individuals found in Illinois show some slight variation:—"general colour, black; antennæ not quite half as long as the body, third joint half as long as the entire antennæ; abdomen more or less sprinkled with white downy matter: wings transparent, third discoidal vein forked near the middle, its basal portion obsolete; stigma nearly three times as long as it is wide, pointed at each end, and pale brown: length to the tips of the closed wings, about one-seventh of an inch.

*Local Reports.*—Mr. Daly writes (August 1889) from Conoor:—"It (*S. lanigera*) has destroyed nearly every orchard in Conoor." \* \* "I have syringed the trees affected, with the kerosine and soap emulsion, afterwards applying lime and ashes with a little salt. I hope I have not killed the trees. I cannot see any blight now, but some of the leaves look as if fire had been placed to them. A friend tells me that they have

got to the roots of his trees and no remedies he can apply eventually destroy them."

Under date November 13th, Mr. Daly writes:—"Out of about 400 apple trees I found about six unmistakably affected. I cut all the branches badly attacked and burned them: then mixed a solution of soap (common country) and kerosine with a little turpentine and boiling water, stirring round until it was of the consistency of butter. After allowing it to cool I mixed one bottle of this with twelve of water and applied with a garden syringe to the branches and roots. I also applied the soapy congealed matter to any of the insects concealed in the crevices of the trees and also to the trunks. I applied in the same manner a mixture of lime and ashes with a little salt mixed. For the last ten days none of these insects are visible and the kerosine and soap emulsion does not appear to harm the trees. In some cases the branches attacked have a knotty appearance like that of the hands of a person suffering from chronic rheumatism. I have heard that planting tomato-plants in the neighbourhood of apple trees alleviates the pest." \* \* Under date January 1890, Mr. Daly writes:—"My trial of the tomato-plants has led to no further advance of the pests. I have each individual tree examined by a gardener every morning, who is armed with a small pot of the emulsion and a brush, and if he perceives any new comers, they are treated with a dose of the mixture. The trees attacked are now looking quite healthy, and are apparently free from aphides, which, however, may come back."

It is probable that the aerial or trunk-inhabiting form at certain seasons descends to the roots or to herbage in their vicinity, and again with a change in the season ascends, leaving some members of the colonies, however, always above or below. The tomato-plant may therefore only serve as a source of food for the insect when it descends, and serves to propagate it, and in no way protects the trees. In its aerial form at any rate the insect confines itself to the apple in Europe and does not accept any substitute. The brief account given above will, however, indicate the points to be observed locally, for there can be little doubt that some modifications in the habits of this insect must have arisen to suit it to the comparatively strange climate of Conoor and Bangalore.

*Natural enemies.*—It is probable that insects found to attack the woolly Aphis in other countries will be represented in India. Amongst these are spiders who spin their webs directly over the place where the colony of young lice are found to devour them at their leisure. The next in efficiency are the Chalcid flies (Report, Department Agriculture, United States, 1879, p. 259, t. 6, f. 6: Saunders, Ins. Inj. Fruits, f. 15). The root-inhabiting form is attacked by a Syrphus fly, *Pipiza radicum*, Walsh & Riley (Saunders, Ins. Inj. Fruits, f. 2, 135, 136) in its larval form, when it occurs as a footless maggot of a dirty yellow colour and about quarter of an inch in length. The adult and larval forms of the

Coccinellidæ (Lady-birds) also feed on the plant-lice, and the larvæ of the Lace-winged flies (*Chrysopa*), known by having four delicate lace-like wings (Saunders, *l. c.*, f. 133, 134).

*Remedies.*—For the trunk and branch-inhabiting form is recommended the use of a stiff brush and the application by it of an alkaline wash. This may be made by mixing five seers of fresh lime with one seer of sulphur and four gallons of water and heating until the sulphur is dissolved. Common country soap, reduced to the consistence of paste by the addition of a strong solution of washing-soda in water, also forms a good wash for application with the brush. This should be rubbed into all hollows in the barks, wounds, and wherever the insects appear. The use of the brush and wash has been found effective in England during 1888, and by Mr. Daly at Conoor in 1889. Another effectual but troublesome plan, described by Harris, is to scrape off the rough bark of the infested trees and make them perfectly clean and smooth early in the spring; then rub the trunk and limbs with a stiff brush, wet with a solution of potash; after which remove the earth about the bottom of the trunks, and with the scraper brush an alkaline liquor over that part so far as the roots can be conveniently uncovered. The earth removed should be carried away to a distance or burned, and be replaced by fresh earth, and all cracks and wounds should be filled with grafting cement or clay mortar. Small infested limbs and branches beyond the reach of the application should be cut down and burned.

As a preventive measure, Blot recommends:—"Avoid giving to the nursery, in which the young trees are, any more shade than is absolutely necessary; avoid placing the trees in too flat or humid ground, give to both nursery and orchard all ventilation possible, so that they may be thoroughly aired, and keep the heads of the trees open so as to favour the circulation of air and the drying of the soil: dig up around the trees frequently, and do not allow rubbish to accumulate at the roots; surround each tree with a mixture of soot or tobacco or sand." The application of a remedy must depend in a great measure on the climate and soil, and from the suggestions made here, the Indian fruit-grower must select that one which experience will show him to be the most suitable.

For the root-inhabiting form Dr. Fitch recommends the clearing away of earth from the roots and the application of soap-suds in sufficient quantities to penetrate the excrescences on the rootlets. Similarly, when transplanting young trees, if the lice appear on the roots, they should be dipped in a solution of soap-suds. Others recommend the application of scalding hot water to the bared roots, but if young trees in a nursery are thus treated, care should be taken not to allow the temperature of the water to exceed 120° to 150° Fahr. Plant-lice appear to flourish in some places best in a dry porous soil; hence some recommend that the earth around the crown of a tree should be kept hollowed

into a sort of basin, in order that water may collect there. Weeding too has the effect of bringing the root-lice nearer to the surface and thus making them more easily reached by the hot water, but lime or ashes should be mixed with the earth. Melted resin, mixed with an equal quantity of fish oil, put on the infested spots, whilst warm, with a brush, also applications of spirits of tar, turpentine, urine, kerosine, soft soaps, and other similar substances, have been recommended, but there is little doubt that the kerosine emulsion fulfils the same purpose quite as effectually.

The following works may be consulted with advantage on the life-history of this insect :—

*Buckton, G. B.*:—‘Monograph of the British Aphides,’ iii, 1881, p. 89, t. 105, 106, f. 1 to 6: Ent. Mon. Mag., xx, p. 110.

*Comstock, J. H.*:—Report, Department Agriculture, United States, 1879, p. 258.

*Girard*:—Bull. Insect. Agri., ix, 1884, p. 119, f. 11.

*Goethe, R.*:—Landwirthschaftliche Jahrb., 1883.

*Hausmann, F.*:—Beiträge zu den materialien für eine künftige bearbeitung der gattung der Blattläuse, in Illiger’s Mag. Insekt, i, 1802, p. 426.

*Kessler, H. F.*:—Deutsche Ent. Zeitschrift, xxvii, 1823, p. 26; Ber. Ver. Cassel, 1883, p. 90; Kosmos, xv, 1844, p. 457; Nova Acta Leop. Carol., xlvii, 1885, p. 107, t. xi; S. B. Verh. Zool.-bot. Ges. Wien, xxxv, 1885, p. xxv; ‘Die Entwickelungs—und Lebens-geschichte der Blutlaus, *S. lanigera*, Hausm. Cassel, 1885.

*Lichtenstein, J.*:—Migrations of plant-lice, Ent. Mon. Mag., xv, 1878, p. 134, 166; *ib.*, xx, 1883, p. 79.

*Thomas, C.*:—Eighth Report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, p. 126. Springfield Ill., 1879.

*Bolt, F.*:—Mémoire sur le Pucéron lanigère et sur les moyens de le détruire, Caen, 1831.

*Anon.*:—Programme et résumé des observations et des mémoires présentés à la société d’Agriculture de Caen pour la destruction du pucéron lanigère, Caen, 1830.

*Anon.*:—Moyen de détruire le pucéron lanigère;—Ann. de l’Agric. Franç., (2 s.) xlv, 1828, p. 380.



## V.—DESCRIPTIONS OF NEW COCCIDÆ.

By W. M. MASKELL.

(With one plate.)

[ NOTE.—The first insect described below has recently been found attacking tea in Assam and the Kangra valley. The second has been found on the leaves of tea in the Kangra valley. The third has been found destructive to the plant *Cajanus indicus* in Madras.—E. C. C. ]

Group—*Diaspidinæ*.Genus—*Aspidiotus*, Bouché.

Female puparia circular; pellicles usually in the centre. Male puparia slightly elongated, not carinated; pellicle at one end.

The absence of carination in the male puparia distinguishes this genus from *Diaspis*. The pellicles of the female are not always in the centre, and when this is the case an examination of the male puparium is necessary for certitude.

*Aspidiotus theæ*, Maskell, *sp. nov.*

(Plate I; fig. 1 a, b, c, d, e.)

Female puparia clustered thickly on twigs, as nearly circular as their numbers and position will permit: slightly convex: colour light-brown, covered with a very thin coat of white excretion: pellicles yellow, very small, situated near the margin: the fibrous portion of the puparium rather solid. Diameter averaging  $\frac{1}{10}$  inch.

Male puparium elongated, not carinated: pellicle at one end: colour similar to that of the female.

Adult female brown peg-top-shaped, the cephalic segment rather large, the pygidium comparatively small. The abdominal segments shrink up more and more as the female approaches gestation. Abdomen ending in two median lobes with a smaller lobe on each side: a few spines and small hairs on the edge. Pygidium on the ventral surface, exhibiting four large "spinneret-groups": the upper pair with from 30 to 40 orifices, the lower pair 15 to 25. On the dorsal surface are a number of tubular spinnerets, and a large patch divided into an irregular lattice-work, the spaces of which are not large, and not constant in shape in different specimens, although the size and position of the whole patch is quite constant.

Larva when just hatched bluish, flat, active, length about  $\frac{1}{10}$  inch. The antennæ appear to have six joints, sub-equal, the last widely dilated at the tip and bearing two longish hairs.

Adult male unknown.

*Habitat*.—On tea-plants in India :—(Assam, Kangra valley, &c.)

The form of the male puparium forbids the introduction of this species into the genus *Diaspis*, but I think none of the described species of *Aspinotus* has the female pellicles so close to the margin as this one. The "lattice-work" arrangement on the dorsal surface of the pygidium is peculiar and destructive. The only other instance in which this curious feature is reported (as far as I am aware) is in *Ischnaspis filiformis*, Douglas (Entom. Month. Mag., Vol. XXIV, page 27), but in the description of that species it is not stated whether the lattice-work is on the dorsal or the ventral surface.

*Chionaspis theæ*, Maskell, *sp. nov.*

(Plate I, fig. 2 a, b, c.)

Female puparium (figure a), light-brown, pyriform, flattish: pellicles brownish-yellow, small length, averaging about  $\frac{1}{10}$  inch.

Male puparium (figure b) white; deeply and conspicuously carinated; sides more or less parallel: carinations three or four. Pellicle small, yellow. Texture very loose, the puparium having the appearance of three or four short, nearly disconnected, white cottony tubes. Length averaging about  $\frac{1}{35}$  inch, breadth about  $\frac{1}{70}$  inch.

Adult female brown, elongated, form normal of the genus, with conspicuous posterior segments. Abdomen ending in two median lobes with two others smaller at each side: a deepish median depression: short spines between the lobes, and on the margin three others on each side, the upper pairs of which are rather long and strong. On the last segment above the pygidium two or three longish spines. Five groups of spinnerets: upper group, 8 orifices: upper laterals, 13 and 16: lower laterals, 14: between the groups and the margin a row of single spinnerets. Rudimentary antennæ can be detected on the head. Length of insect about  $\frac{1}{30}$  inch.

Adult male unknown.

*Habitat*.—On tea (Kangra valley, Northern India).

The brown female puparium, the arrangement of the spines on the pygidium and the loose little male puparium, distinguish this from almost all other species of the genus: but it seems, at least in the female, to be very closely allied to *C. brasiliensis*, Signoret. The male puparium, however, in that species is stated to be four times as long as broad, and in texture does not differ from those of other *Chionaspides*, whereas in *C. theæ* it is half as broad as long, and loose in texture.

Group—*Lecanidinæ*.

Sub-division—*Lecano Coccidæ*, Maskeel.

Genus—*Eriochiton*, Maskeel.

Adult female insects covering themselves with a test of felted matter,

forming more or less complete sacs. Abdominal cleft and lobes present in all stages. Male pupa covered with similar excretion (*Scale Insects of New Zealand*, 1887, page 84).

I have omitted from these generic characters one —“ Secretion is conspicuous or absent on adult females,” which I included in 1887. Such a character, depending merely upon the *quantity* of the matter covering the insect, is after all more accidental than otherwise, and at best ought only to avail for specific differentiation.

*Eriochiton cajani*, sp. nov.

(Plate I, fig. 3 a—n.)

Test of adult female dirty-grey, moderately thick; so closely felted as to almost resemble wax: elliptical, convex above, usually open beneath, but sometimes closed: covering the insect completely. The tests are congregated in masses on the twigs, mixed with male puparia and with the younger females. There is usually no marginal fringe, but sometimes a fringe of small segments may be detected: the edges are somewhat thicker than the rest. Surface of the test often rugose, as if composed of many small irregular segments. Length about  $\frac{1}{12}$  inch.

Test of male pupa elongate-elliptical, convex, whiter and cleaner-looking than that of the female: very thin, transparent and brittle: at the edge there is a small fringe of very minute segments. Length about  $\frac{1}{20}$  inch.

Larva elliptical, flattish, active, naked: colour reddish-yellow: length about  $\frac{1}{50}$  inch: exhibiting a rather wide abdominal cleft with lobes which do not project beyond the extremity. Antennæ of six joints, of which the third is the longest, the second the shortest, the rest sub-equal: there are a few hairs on each joint, and on the last one, hair very much longer than the rest. Feet rather long, slender: the tibia is longer than the tarsus (a very abnormal character amongst coccids of all groups): a few hairs on each joint: upper digitals rather thick, lower pair only slightly dilated at the ends. Mentum monomerous. Abdominal lobes small, each bearing one very long seta and a short spine. Anal ring with six longish hairs. The spiracular spines are very long: and all round the margin is a row of minute conical spines.

Female of the second stage reddish yellow; elongate-elliptical, flattish, active: length about  $\frac{1}{32}$  inch. Antennæ of six sub-equal joints, the last bearing some shortish hairs. Abdominal cleft wide, as in the larva: lobes short, each bearing six shortish setæ, arranged in pairs. Anal ring with numerous hairs. There is a thin, white, mostly fragmentary test, which at the edges forms a fringe of short cylindrical tubes: these tubes spring from the marginal conical spines, which are of two sizes, as in the adult.

Adult female dull brownish-yellow : at first elliptical, tapering somewhat posteriorly, convex, and filling the test : afterwards shrivelling up towards the cephalic end of the test : length from  $\frac{1}{20}$  to  $\frac{1}{15}$  inch. Epidermis rugose, as in the test. Abdomen ending in a rather wide cleft with short broad lobes, each lobe bearing two short unequal setæ. Anogenital ring with very numerous hairs. Antennæ of seven sub-equal joints, the last bearing a few short hairs. Feet slender, upper digitals long and rather thick, lower pair very widely dilated at the ends : tibia longer, but not much longer, than the tarsus. Edges of the body rather thick, bearing a double row of conical spines, one row larger than the other. Spiracular spines very long. There are a good many tubular spinnerets on the dorsum, mostly near the edges.

Male pupa reddish-brown : length about  $\frac{1}{5}$  inch. Four dorsal and two ventral eyes can be made out, and two ocelli.

Adult male unknown.

*Habitat*.—On *Cajanus indicus* in Madras, <sup>1</sup> India.

This insect is clearly Lecanid, from the abdominal cleft, the very numerous hairs of the anogenital ring, and the seven-jointed antennæ of the adult. It exhibits characters closely allied to those of four described genera. From *Signoretia*, Targioni, it differs in its much more closely felted test and in the antennæ, that European genus having antennæ of eight joints. *Eriopeltis*, Signoret, and *Philippia*, Targioni, have both loose cottony sacs and antennæ of six joints. But the genus *Eriochiton* in New Zealand differs only in the *quantity* of the excreted matter covering the adult female. In the New Zealand forms this is usually fragmentary or inconspicuous, being most easily seen in the second stage : in the Indian insect it is thick and constant on the adult. But such a character may fairly be considered as only trivial. There is indeed one point in which the new species differs from all the above : and that is the length of the tibia, as compared with the tarsus, in the larva. But this indeed is so abnormal that, if stress were laid on it, not only a new genus, but a new group would have to be established to include the insect : because it is probably an invariable mark of the larval stage in any other coccid that the tarsus is longer than the tibia. Setting, then, this aside, there seems to be no genus to which this insect can be so well ascribed as *Eriochiton*, and it has therefore been here so placed.

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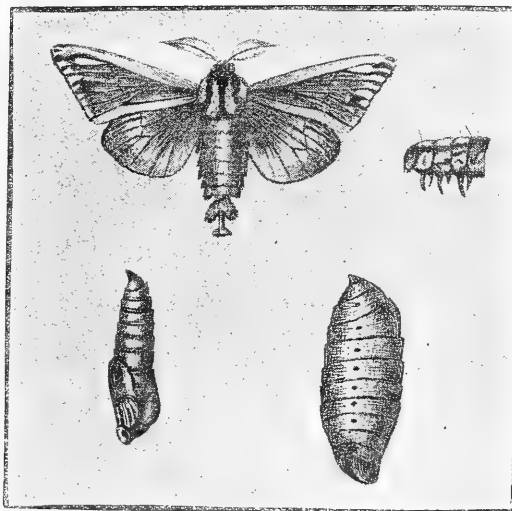
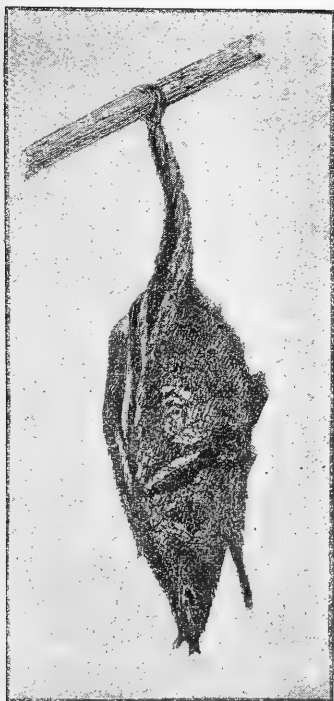
<sup>1</sup> The specimens were furnished, in January 1890, by the Assistant Director of Land Records and Agriculture, Madras, as destructive to the plant *Cajanus indicus*.

## VI.—A DARJILING SAL PEST.

By G. C. DUDGEON.

[NOTE.—A specimen of this insect, furnished by Mr. Dudgeon, has been examined by Mr. F. Moore, who determines it as a *Psychid* belonging to a new species of *Eumeta*, which he describes on page 66 under the name of *Eumeta sikkima*.—E.C.C.]

The larva of this moth is found everywhere in the Darjiling district where sâl trees grow, and would be perhaps the most to be feared as a pest, should it increase greatly, which it has apparently little to prevent it from doing. It appears, however, to be little known, probably on account of its ability of hiding itself within its case, made of moss, bark and dried leaves, at the slightest alarm, and in this manner making itself almost indistinguishable from the bark or twigs near which it may be suspended whilst feeding. Before describing the larva I will proceed to give a short description of the perfect insects, male and female.



The male moth, which, like others of the same family, is alone perfectly developed (the female being a mere bag of eggs without any limbs, wings, eyes, or even antennæ), measures 2·8 inches in expanse.

Wings entire. The scales on both wings are sparsely scattered. The fore wing has the whole space between the costal margin and the subcostal nervure reddish ochre; the discoidal cell distinctly divided into three portions by two interlineal nervules; the whole space between the submedian nervure and the inner margin reddish ochre. All the rest of the fore wing, with the exception of the following markings is semitransparent, and powdered with fuliginous scales; all the nervules are defined distinctly with black; the interspace above the first discoidal nervule is white, basally; there is a marginal triangular white spot in the interspace between the first and second discoidal nervules; the first median nervule is bifurcated from the base, enclosing a large marginal quadrate spot; there is a submarginal black patch connecting the lower branch of the first to the second median nervule; there are also pale spots along the margin between the second and third median nervules, and the third median nervule and submedian nervure. The hind wing is semitransparent fuliginous, with the nervules only slightly darker; the base of the wing is clothed with long dark brown hairs. The antennæ are highly pectinated and are about a third of the length of the fore wing. Eyes smooth. Legs densely covered with hair. Thorax whitish buff with central and subdorsal black longitudinal bands. Abdomen covered with dark brown hair.

The female, which never completely emerges from the pupa shell, unless by accident, until it has laid all its eggs, is simply a skin full of eggs, with a scutellate formation at the head end, and an ordinary ovipositor and sexual organs at the other. My figure gives a correct representation, magnified  $2\frac{1}{2}$  diameters, of all that is visible outside the pupa case. There does not seem to be any trace of any limbs or features, which are present in the male. The head end consists of a sharp beak-like protuberance, with an edged under surface, followed by two short pointed processes on a wrinkled hard surface. The backs of the thoracic segments are covered with a hard shell-like formation, of a light brown colour, resembling the pupa shell, but smoother and lighter coloured. The abdomen is of a pale buff colour, with a broad dorsal and narrower lateral yellowish line, extending throughout. There is a ring of tawny velvety scales round the last segment but one, formed of extremely fine scales and the end of the abdominal part of the pupa shell is filled with loose scales of a different shape, which the insect drives out of its pupa shell by means of its maggot-like contortions. I believe that the expulsion of these scales serves to attract the male, and they are probably odoriferous; they are also used to cover the eggs, which are always laid inside the pupa shell. Some collectors have thought that the part of a female Psychid moth which protruded from the cocoon was the sexual organ, but had they seen a male copulating with the female, they would at once have recognised their mistake. Indeed, the head end has at first sight somewhat the appearance of some insects' sexual organs.

The males of this and another species of the same family in my collection, kindly named for me by Mr. Moore as *Gorisana bipars* (?) (Walker), are easily attracted to virgin females. I have taken seven males of the latter species in about two hours, by hanging a virgin female on the branch of a tree, and preventing connection, and when at last connection was formed, I saw one or two males flying round a few yards away, but they did not settle, and only left again in a few minutes. Copulation is formed by the male settling on the head of the female and forcing its abdomen, which it is capable of producing to more than half again its original length, in between the pupa shell and the body of the female, in the meantime the latter performs a series of contortions which facilitate the insertion of the male's abdomen.

The female lays its eggs within the pupa shell among the remaining loose scales, which have not been emitted and which serve as a kind of protection for the eggs. After laying all, or nearly all, its eggs, its abdomen so decreases in size that it drops out of the chrysalis shell and dies. The eggs are yellow, simple, smooth ovals, slightly squared at the ends and unmarked. The outer covering is not hard and shell-like, but is simply a skin, and the least touch will put the egg quite out of shape and useless. The egg stage appears to be the most critical part of the insect's life, as during the larva and pupa stages it is practically safe from the attacks of birds, and from other insects, except ants; but I have often found the empty female's cocoons inhabited by earwigs, and small beetle larvæ, which lead me to think that the eggs have been eaten by these intruders.

The larvæ emerge about the first of April from eggs laid at the beginning of March in the same year. This is the first brood of the year, but the others do not follow in any regularity, and it has been impossible for me to ascertain how many broods there are, as the larvæ and pupæ are found in all stages throughout the rains. Larvæ when first emerged are about one-sixteenth of an inch in length. Colour reddish brown. Heads large, mandibles strong. Body cylindrical, tapering towards the tail end. Pectoral legs large, long, and very powerful; abdominal legs, seen perfectly through magnifying glass, semideveloped, ten in number, including anal legs. Pectoral segments dorsally covered with a light brown shell-like covering. They do not seem to utilise the old cocoon in the construction of their own cases, and walk about for days with the abdominal segments always held perpendicular to the rest of the body. Some form cases about the third or fourth day from bits of moss and bark of sâl trees on the leaves of which they feed, but they constantly desert their cases at first. The larva feeds on the young leaves of the trees at this stage, but afterwards seems almost to prefer the old and tough ones. The larva never leaves its case after it has once begun to enlarge it, which it does by adding small bits of moss, leaves, flowers, stalks, and in one

case the elytra of a beetle was used. The mouth of the case is always made flexible, so that, when alarmed, the insect can draw in its head and the mouth of its case as well. If a full-grown larva be removed from its case (which can only be done by cutting the case open, as it seems to prefer death to being squeezed out) it will be found that it is almost helpless and cannot progress at all on a flat surface, as its anterior legs are too long and its prolegs are too short, and are useless to it without its case. The whole body is a purplish brown, covered with short bristles; the anterior segments have a dorsal shell-like covering of a pale buff colour, variegated with reddish brown. The head is reddish brown, and not very large. The abdomen has a lateral row of small red spots encircling the breathing apertures. Anterior legs strong and rather long. Prolegs very small. When the larva is about to undergo its change, it fastens the upper part of the case firmly round a twig or on to the bark of a tree, and draws out the mouth in the shape of a neck, which it closes. It then covers the inside of the case, now converted into a cocoon, with a very fine, soft loose silk, and then turns round, keeping its head downwards for the change.

The pupa of the male insect is of the usual shape, cylindrical, shiny dark, mahogany coloured. The abdomen is rather long and pointed. Wings and thorax short, antennæ large, broad. Palpi enclosed in a small blunt process at the top of the head. All the abdominal segments are minutely toothed dorsally, and there are a few short bristles on the mesothorax. By this means the pupa can easily draw itself upwards or downwards. The cocoon of the male is smaller than that of the female.

The pupa of the female insect is very much thicker than the male, and is also of a lighter reddish brown colour. Length 1 to 1.17 inches, greatest breadth .42 to .5 inches. Shape cylindrical, attenuated at both ends (anal end rather suddenly so), and ending in a sharp curved point; other end truncated and wrinkled, with no trace of the features usually apparent in lepidopterous pupæ. This end is bluntly beaked and keeled on the back of the first three segments. The fourth segment projects slightly over the fifth. There are breathing apertures from the fourth to the tenth segments along the sides. On the under surface of the fifth to eighth segments, there is a sublateral row of dark dots, one on each segment. The whole surface, with the exception of the wrinkled parts on the first three segments, is smooth, and the edges of the segments are slightly defined with dark brown. The edges of the two thickest segments are furnished with a minute row of teeth-like processes, apparently to enable the pupa to work itself upwards or downwards at will. When the pupa changes to the perfect insect, the shell covering the head and thoracic segments alone is cast off, and the



insect cuts its way out of the lower end of its cocoon by means of its sharp edged beak, propelling itself forward by the aid of the two pointed processes and the toothed segments of the abdomen of the pupa shell.

I have occasionally found the caterpillar singly on tea bushes adjoining sâl forest, but, although they eat the leaves, they do not appear to do so by preference, neither do they feed gregariously, as is the case with the larvæ of *Govisana bipars* (?) (Walker), which completely strips the tea bushes it feeds on and often kills them by taking off the bark to make its case.

[NOTE.—Since writing this, I have taken the larvæ commonly on tea bushes at elevations of from two to three thousand feet above sea-level in this district.]

## VII.—A NEW PSYCHID INJURIOUS TO SÂL.<sup>1</sup>

By F. MOORE.

*Eumeta sikkima* (nov. sp., Moore), nearest allied to the Ceylonese *E. layardi* (Moore, Lep. Ceylon, II, 102, pl. 118, fig. 2, ♂). Darker coloured generally. Fore wing with the costal border, the area longitudinally below the cell, and the posterior border darker brown; the veins also blacker. On the hind wing the general colour is also darker throughout. Body much darker coloured, and the black tufts of hairs on thorax and abdomen more prominent. Expanse of wings  $1\frac{3}{4}$  inch.

*Habitat*.—Sikkim.

The larva feeds on the sâl (*Shorea robusta*), and forms a large fusi-form case longitudinally covered with leaves of the tree, and before pupating suspends the case to an adjacent twig.

[NOTE.—*E. sikkima* is quite distinct from the Ceylonese *E. crameri* and its ally the Bombay *E. leithii*, both of which latter species are much smaller in size, and each have the antennal combs on both sides of the shaft about half the length of those in *E. layardi* and *E. sikkima*, the breadth of the antennæ in both the latter species being conspicuously broad. All the species of the genus *Eumeta* are much alike, superficially. *E. crameri*, *E. leithii*, and *E. layardi* are stated to form twig-covered cases, whereas the Sikkim species covers its case with leaves.]

<sup>1</sup> The life-history of this species is described above by Mr. G. C. Dudgeon.

1. *Chlorophyll a* and *Chlorophyll b* contents were determined by the method of Lichtenthaler and Whistler (1973).

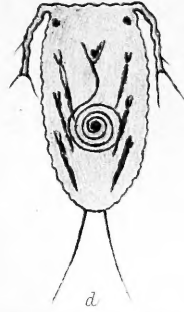
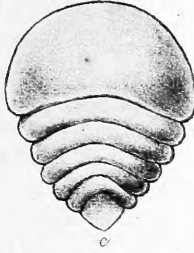


Fig 1 - ASPIDIOTUS THEAE.



Fig 2 - CHIONASPIS THEAE.

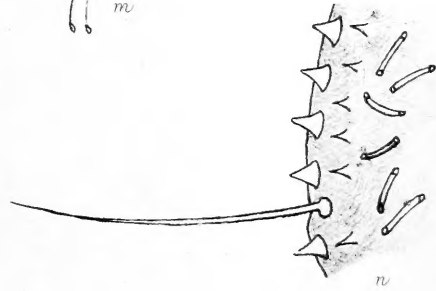
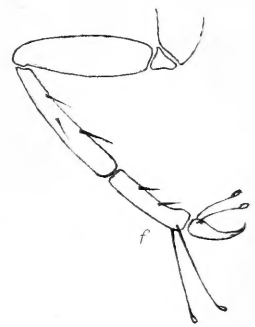
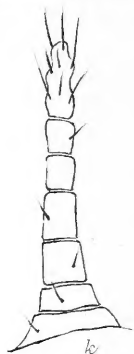
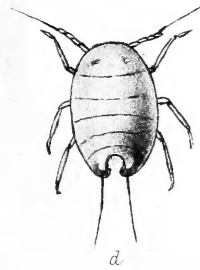


Fig 3 - ERIOCHITON CAJANI



## EXPLANATION OF PLATE I.

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Fig. 1. *Aspidiotus theæ*, Maskell—

*a.*—Puparia on twig, nat-size; *b.*—Puparia ♂ & ♀,  $\times 2$ ; *c.*—Adult female,  $\times 20$ ; *d.*—Larva,  $\times 100$ ; *e.*—Antenna of larva,  $\times 350$ .

Fig. 2. *Chionaspis theæ*, Maskell—

*a.*—Puparium ♀; *b.*—Puparium ♂; *c.*—Adult female.

Fig. 3. *Eriochiton cajani*, Maskell—

*a.*—Tests on twig, nat-size; *b.*—Female tests, dorsal and ventral aspects; *c.*—Male test, dorsal aspect; *d.*—Larva, dorsal aspect; *e.*—Antenna of larva; *f.*—Foot of larva; *g.*—Female 2nd stage, dorsal aspect; *h.*—Adult female, dorsal aspect; *i.*—Antenna of adult female; *m.*—Foot of adult female; *n.*—Marginal spines, spiracular spine, and tubular spinnerets of adult female.

